Chapter 4, Section 4.3
Status and Recovery of Middle Fork Salmon River MPG in the Snake River Spring/Summer Chinook Salmon ESU

Table of Contents

[This page intentionally left blank]

4.3 Middle Fork Salmon River MPG

The Middle Fork Salmon River MPG consists of spring and summer Chinook returning to the Middle Fork Salmon River subbasin, in addition to spring Chinook returning to Chamberlain Creek and other nearby tributaries on the main Salmon River. The MPG includes the nine independent populations shown in Figure 4.3-1: (1) Big Creek, (2) Lower Middle Fork Mainstem (below Indian Creek), (3) Upper Middle Fork Mainstem (above Indian Creek), (4) Camas Creek, (5) Loon Creek, (6) Sulphur Creek, (7) Bear Valley Creek, (8) Marsh Creek, and (9) Chamberlain Creek. The ICTRT classified Big Creek as a Large-sized population; Bear Valley, Chamberlain Creek and the Upper Middle Fork as Intermediate-sized populations; and the remaining populations as Basic-sized (Table 4.3-1)(ICTRT 2007). None of the populations in the MPG has received hatchery supplementation and there is no history of hatchery-origin Chinook spawning in this group of populations.

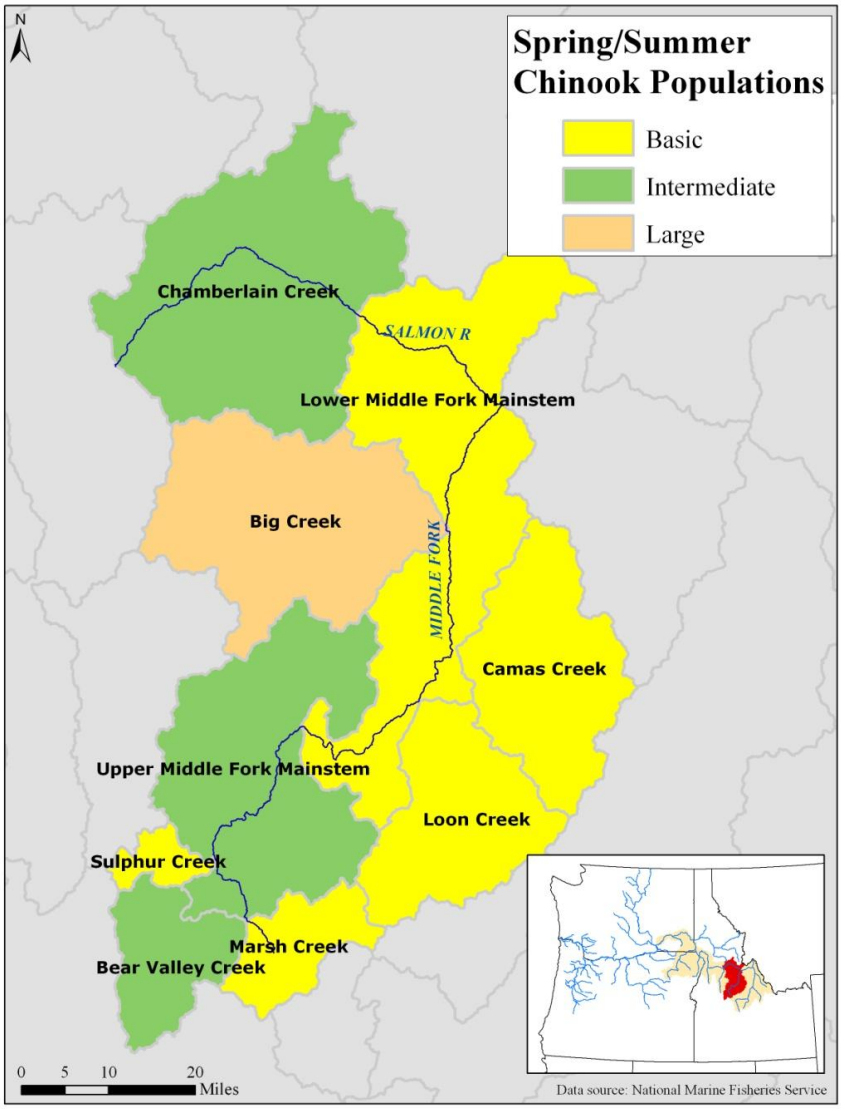

Figure 4.3-1. Middle Fork Salmon River spring/summer Chinook major population group (MPG) and independent populations. Colors indicating population size based on historic habitat potential.

The ICTRT classified these fish as a major population group based on genetic differentiation and geographic isolation from other populations in the Salmon River. Although genetic data are limited, Chinook spawning in the Middle Fork subbasin appear to be genetically differentiated from other Salmon River populations. The Chamberlain Creek population on the main Salmon River is genetically divergent from all other populations in the ESU (ICTRT 2003) but is included in the Middle Fork MPG based on geographic proximity (ICTRT 2005). The Middle Fork Salmon River subbasin and Chamberlain Creek are separated by a large distance from Chinook spawning locations in the South Fork Salmon River and in the Upper Salmon River. The spring-run type predominates in this MPG, but summer-run fish are present in Loon Creek, Big Creek, and the lower Middle Fork mainstem.

Table 4.3-1. Middle Fork Salmon River spring/summer Chinook MPG population characteristics. Minimum abundance and productivity values represent levels needed to achieve a 95% probability of existence over 100 years (ICTRT 2007).

Population	Extant/ Extinct	Life History	Size	Threshold Abundance	Minimum Productivity
Chamberlain Cr	Extant	Spring	Intermediate	500	2.21
Big Creek	Extant	Spr/Sum	Large	1,000	1.58
Lower MF Salmon	Extant	Spr/Sum	Basic	500	2.21
Camas Creek	Extant	Spring	Basic	500	2.21
Loon Creek	Extant	Spr/Sum	Basic	500	2.21
Upper MF Salmon	Extant	Spring	Intermediate	750	1.76
Sulphur Creek	Extant	Spring	Basic	500	2.21
Bear Valley Creek	Extant	Spring	Intermediate	750	1.76
Marsh Creek	Extant	Spring	Basic	500	2.21

4.3.1 Viable MPG Scenarios

The ICTRT incorporated the viability criteria (ICTRT 2007) into viable recovery scenarios for each MPG. The criteria, which are explained in detail in Chapter 3, Recovery Goal and Delisting Criteria, should be met for a MPG to be considered viable, or low risk, and thus contribute to the larger objective of species' viability. These criteria are:

1. At least one-half the populations historically present (minimum of two populations) should meet viability criteria (5% or less risk of extinction over 100 years).
2. At least one population should be highly viable (less than 1% risk).
3. Viable populations within a MPG should include some populations classified as "Very Large'" or "Large," and "Intermediate" reflecting proportions historically present.
4. All major life history strategies historically present should be represented among the populations that meet viability criteria.
5. Remaining populations within an MPG should be maintained (less than 25% risk) with sufficient abundance, productivity, spatial structure and diversity to provide for ecological functions and to preserve options for species' recovery.

The criteria suggest several viable MPG scenarios for the Middle Fork Salmon MPG:

- At least five of the nine historical populations must meet viability criteria, one of which must meet highly viable criteria.
- The five viable populations should include at least the one Large population (Big Creek) and two of the three Intermediate populations (Upper Middle Fork Salmon River, Chamberlain Creek, and/or Bear Valley Creek).
- All life histories must be present: requires that the Big Creek population, a summer run, achieve viable status.
- All remaining populations should at least achieve maintained status.

4.3.2 Current MPG Status

The ICTRT also used the viability criteria to determine the current status of the MPG. The ICTRT completed status assessments for all populations in the MPG (ICTRT 2010), which inform the MPG-level criteria. The current status for each population is the cumulative risk resulting from the population's abundance, productivity, spatial structure and diversity risks. Because of lack of sufficient abundance data, some populations required a qualitative determination of the abundance/productivity risk level. An explanation of whether an empirical or qualitative method was used to determine the abundance/productivity risk rating is included in the overview of each population's current status, provided later in this chapter. Currently, the Middle Fork Salmon River Chinook MPG does not meet the MPG-level viability criteria. All nine populations are at high abundance and productivity risk (Table 4.3-2).

Table 4.3-2. Viable Salmonid Population (VSP) risk matrix for independent populations in the Middle Fork Salmon River Chinook MPG with current status, as determined from ICTRT population viability assessments (ICTRT 2010).

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	HR
	High (>25%)	HR	Chamberlain Bear Valley Marsh	Big Creek Lower Middle Camas Loon Upper Middle Sulphur	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

4.3.3 Viability Gap

A population's gap represents the improvements in abundance (the total number of adults) and productivity (the ratio of returning adults to the parental spawning adults) that are necessary for a population to achieve its desired status. As such, the gap is a good indicator of the level of effort needed to achieve recovery.

Gaps are measured as the necessary improvement in survival rates. More information can be found in ICTRT (2007b) regarding how the required survival changes were calculated. For each population the ICTRT quantified gaps as necessary changes in survival rates to achieve three different extinction risk levels: very low risk (Highly Viable), low risk (Viable), and moderate risk (Maintained). For each risk level, the gap is expressed as a range based on favorable and unfavorable ocean conditions, to account for uncertainty about future climate and ocean conditions.

[Section is under development]

4.3.4 MPG Limiting Factors and Threats

Many limiting factors and threats impact the viability of Idaho's Snake River spring/summer Chinook during their complex, wide-ranging life cycle. This section summarizes the impacts on Middle Fork Salmon River Chinook populations from natal habitat alteration and hatchery programs. Section 4.1.1 summarizes the regional-level factors that impact all Idaho Snake River spring/summer Chinook populations. Limiting factors and threats specific to individual Middle Fork Salmon spring/summer Chinook populations are discussed in the Population Summaries in Section 4.3.6.

4.3.4.1 Natal Habitat Alteration

[Section to be developed]

4.3.4.2 Hatchery Programs

[Section to be developed]

4.3.4.3 Fisheries Management

[Section to be developed]

4.3.5 MPG Recovery Strategy

4.3.5.1 Desired Population Status

The recovery strategy for this major population group includes achieving a desired status for each population within the MPG. There are multiple viable MPG scenarios for the Middle Fork Salmon River spring/summer Chinook MPG, as described in section 4.3.1. To provide focus for this recovery plan, NMFS and the state of Idaho have selected a desired status for each population, matching one of the viable MPG scenarios. The selections are described below and shown in Table 4.3-3. It is

important to note, however, that any viable MPG scenario satisfying the criterion in 4.3.1 is acceptable for achieving the recovery goal.

Big Creek Population

As described previously, the Big Creek population must achieve at least viable status under any viable MPG scenario because it is the only large-sized population. This population provides a large amount of suitable spring/summer Chinook habitat, most of which is in relatively pristine condition, and has a higher recent productivity than all but two other populations in the MPG. As a result, the population is targeted to achieve a desired status of ***Highly Viable***, with very low (less than 1%) risk of extinction over 100 years.

Bear Valley Creek Population

Bear Valley Creek is one of three intermediate-sized populations, two out of three of which must achieve at least viable status. Bear Valley Creek has been selected as one of these two populations because it has extensive meadow stream habitat in good condition and highly suitable for spring/summer Chinook, has a relatively high recent productivity, and is more easily accessible for monitoring purposes than other Middle Fork populations. There is a high demand for Tribal and non-Tribal recreational harvest opportunities in this watershed. The desired status for the Bear Valley Creek population is ***Viable,*** with a low (1-5%) risk of extinction over 100 years. This will accommodate some degree of harvest impact to the population.

Chamberlain Creek Population

Chamberlain Creek is an intermediate-sized population, so it fulfills the need for at least two intermediate-sized populations to reach viable status. Chamberlain Creek is also an important population because it provides connectivity between the South Fork Salmon, Middle Fork, and Upper Salmon MPGs. Furthermore, the population is genetically unique in the ESU and has the highest estimated recent productivity in the MPG. The desired status for this population is ***Viable,*** with a low risk of extinction over 100 years.

Marsh Creek Population

March Creek is a basic-sized population that occupies extensive low-gradient meadow habitat in good condition, similar to Bear Valley Creek. Compared to Sulphur Creek, the other basic-sized population in the Middle Fork headwaters, Marsh Creek spawning and rearing habitat is less isolated (with greater connectivity to Bear Valley Creek) and is more extensive. The desired status for this basic-sized population is ***Viable,*** with a low risk of extinction over 100 years.

Loon Creek Population

The Loon Creek population provides geographic connectivity between the Middle Fork headwaters and lower tributaries, it has a comparatively higher recent productivity estimate than the remaining basic-sized populations within the MPG, and its summer-run component contributes to a diversity of life history strategies. The desired status for this population is ***Viable,*** with a low risk of extinction over 100 years.

Upper Middle Fork Mainstem Population

The Upper Middle Fork Mainstem population is composed of a number of small tributaries rather than a core, contiguous spawning area. Because of its remote location in a wilderness area and the

dispersed nature of potential Chinook spawning, very little information is available to determine and track the status of the population. The desired status for this population is ***Maintained,*** with only a moderate (25% or less) risk of extinction over 100 years.

Lower Middle Fork Mainstem Population

Chinook spawning in this population is primarily restricted to the mainstem Middle Fork Salmon River and Horse Creek, a tributary to the main Salmon River. Tributaries in this population typically are small, high gradient, and do not provide suitable spring/summer Chinook spawning habitat. Because of its remote location in a wilderness area and the dispersed nature of potential spring/summer Chinook spawning, very little information is available to determine and track the status of the population. The desired status for this population is ***Maintained,*** with a moderate risk of extinction over 100 years.

Sulphur Creek Population

Although it supports Chinook spawning in high elevation meadows, Sulphur Creek has the least amount of potential habitat of any of the Middle Fork populations. Compared to Marsh Creek, the other basic-sized population in the Middle Fork headwaters, Sulphur Creek spawning habitat is more isolated from other populations. The desired status for this basin-sized population is ***Maintained,*** with a moderate risk of extinction over 100 years.

Camas Creek Population

Camas Creek has the lowest recent productivity estimate of the Middle Fork populations. Its desired status is ***Maintained,*** with a moderate risk of extinction over 100 years.

If each population achieves its desired status, shown in Table 4.3-3, the Middle Fork Salmon River MPG will be viable.

Table 4.3-3. Viable Salmonid Population (VSP) risk matrix for independent salmonid populations in the Middle Fork Salmon River MPG, with desired status shown for each population.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	Big Creek HV	V	M
	Low (1-5%)	V	Chamberlain Bear Valley Marsh V	Loon V	M
	Moderate (6 – 25%)	M	M	Lower Middle Camas Upper Middle Sulphur M	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

4.3.5.2 Recovery Strategies and Actions

The recovery strategy for the Middle Fork Salmon River MPG increases abundance and productivity for all populations. The VSP risk matrix (Table 4.2-3 and Table 4.2-4), shows that each population requires a decrease in abundance/productivity risk to reach its desired status of highly viable (very low risk), viable (low risk), or maintained (moderate risk). The current spatial structure/diversity risk for each population, on the other hand, is acceptable for all populations except for Big Creek to achieve their desired status. The moderate current spatial structure/diversity risk for many of the Middle Fork populations is due to lack of phenotypic or genotypic data. Additional data collection and analysis may show that diversity risk for these populations is lower than moderate risk. The recovery strategy for this MPG is therefore to increase abundance and productivity, and to further analyze diversity risk.

Increases in population abundance and productivity will come from the cumulative positive impacts of recovery actions targeting every life stage. Because all of the populations in this MPG are currently at high risk, recovery actions will be needed at each stage to increase survival.

Natal Habitat

Most natal habitat for the spring/summer Chinook populations in the Middle Fork Salmon MPG is currently in good condition, protected from human impacts by the Frank Church River of No Return Wilderness, which encompasses much of the basin. The primary recovery goal is to protect the current high quality of exiting habitat. However, there are limited opportunities to generate small increases in abundance and productivity through habitat restoration. Priority spawning and rearing habitat recovery actions in this MPG are summarized as follows:

1. For some populations, specific actions have been identified to improve habitat, such as road decommissioning, rehabilitating historic mining areas, evaluating and improving water diversions, and encouraging beaver activity.
2. In populations where nonnative brook trout are established, manage brook trout to minimize their occurrence and reduce potential competition with spring/summer Chinook.
3. Investigate the feasibility of increasing nutrients in those areas of the MPG where lack of nutrients may be limiting productivity.

These priorities address the primary habitat limiting factors in the MPG. The population summaries in section 4.3.6 identify other actions for specific populations in specific areas, but these actions address the primary limiting factors identified at this time.

Natal habitat actions in the Middle Fork Salmon River basin will not produce the increases in survival needed for this MPG to achieve viability. Improvements in survival will need to come from additional "downstream" recovery actions. NMFS used the Chinook populations in this MPG, which are located primarily in designated wilderness and have nearly pristine habitat, to roughly estimate the magnitude of survival increases needed from "downstream" actions for all Salmon River populations. It will take a roughly 40 percent increase in survival for each Middle Fork population to reach viable status, so this recovery plan calls for a 40 percent increase in Snake River spring/summer Chinook survival from downstream actions over the long term.

The combined improvements from the small number of natal habitat actions already funded and the prospective downstream survival improvement of 40 percent will likely achieve the desired status for the Middle Fork Salmon MPG. Potential survival increases from natal habitat and downstream actions are rough estimates based on numerous broad assumptions. Monitoring programs and improvements to survival models over the life of the recovery plan to improve these predictions are an important part of the recovery process.

Hatchery Programs

[Section to be developed]

Fisheries Management

[Section to be developed]

4.3.6 Population Summaries

The following sections summarize the results of the population viability assessments completed for the nine independent populations in the MPG. Also included for each population is a description of habitat conditions and threats to the population, limiting factors assessment and recovery strategy for the population.

4.3.6.1 Big Creek Spring/Summer Chinook Population

Abstract/Overview

The Big Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity and moderate spatial structure/diversity risk status. Its targeted desired status is Highly Viable, which requires a minimum of very low abundance/productivity risk and low spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Highly Viable

The actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained. Additional actions, beyond those specifically identified in this recovery plan, will be needed to achieve a highly viable status.

The best remaining opportunities for additional improvement to Big Creek spring/summer Chinook survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake, and Columbia river migration corridors. Some of these potential additional recovery actions may be identified and implemented in the near term. However, the major opportunity for identifying additional actions to increase survival will occur after the analysis of the information being collected during the 10-year term of the 2008 FCRPS Opinion, the U.S. v. Oregon Agreement, and the Pacific Salmon Treaty. The monitoring and research information collected during this 10-year period, particularly in the mainstem rivers, will provide a very important opportunity to re-evaluate the status of the species and will provide additional knowledge that will guide the next round of actions under this recovery plan.

There is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the desired status, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the Big Creek spring/summer Chinook population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns

identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The ICTRT (2003) distinguished Big Creek spring/summer Chinook as an independent population based on drainage size and historical abundance. The population is classified as large-sized, with the potential to achieve a minimum annual mean of 1,000 spawners. Extensive spawning surveys exist for this population, with some index reaches surveyed annually since 1957 and all potential spawning habitats in the population surveyed annually starting in 1995. The Big Creek population exhibits non-linear type spawning complexity. This population contains both spring and summer run fish and consists of three major spawning areas: Lower Big Creek, Upper Big Creek, and Monumental Creek (Figure 4.3-2). No minor spawning areas have been identified for the population. Current spawning distribution mirrors historical distribution, such that all major spawning areas are occupied at both the lower and upper ends, based on recent spawner surveys. The major adult life history strategy is spring-run timing in the upper reaches and summer-run timing in the lower reaches. The drainage is only moderately isolated from the spawning habitat in the lower mainstem Middle Fork Salmon River.

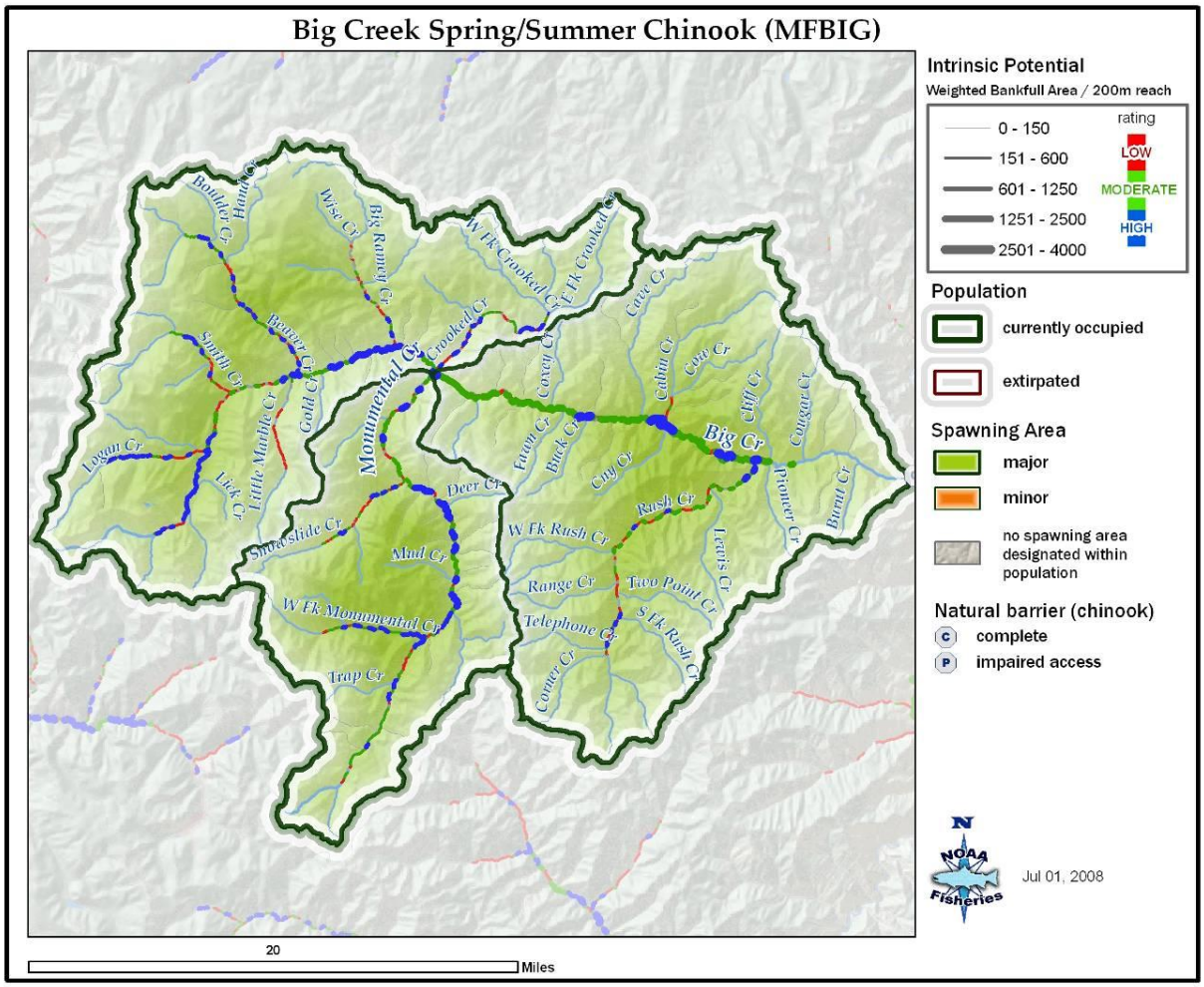

Figure 4.3-2. Big Creek Spring/Summer Chinook Population.

Abundance and Productivity: The viability target abundance and productivity for this population is to achieve a mean abundance threshold criteria of 1,000 naturally produced spawners with a productivity of 2.30 (ICTRT 2007b). In contrast, the recent (2000-2009) 10-year geometric mean adult spawner abundance for the Big Creek spring/summer Chinook population is 146 fish. Based on recent adult spawner recruit series, the 10-year recruit per spawner productivity estimate for the same period is 0.80, less than the 2.30 productivity required for highly viable status at the minimum abundance threshold (Ford et al. 2010). The abundance/productivity risk for the population is therefore high.

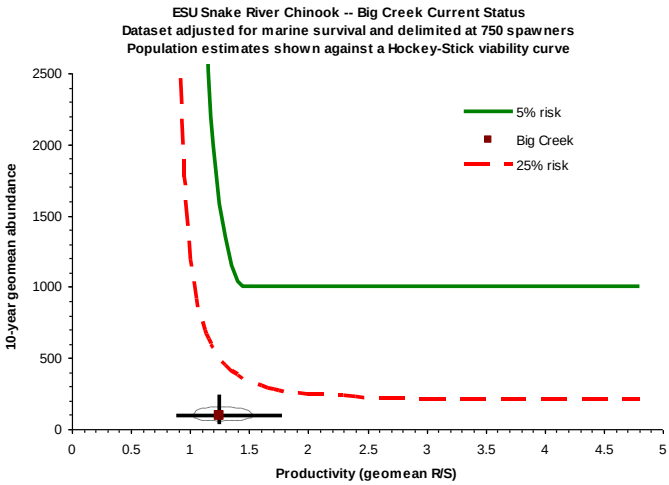

Figure 4.3-3. Big Creek spring/summer Chinook abundance and productivity curve.

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance (measured as spawners) and productivity (measured as brood year spawner to spawner ratios) that correspond to a particular risk level. As seen in Figure 4.3-3, the desired risk level can be achieved with various combinations of abundance and productivity. For the Big Creek population, viable status can be attained with any combination of abundance and productivity that is above the green line. The level of very low risk, required to achieve a desired status of highly viable, is not shown graphically in Figure 4.3-3, but would require a combination of abundance and productivity even farther above the green curve.

Spatial Structure: The Big Creek population is a large-sized population with a non-linear type spawning complexity. The population contains both spring and summer run fish and includes three major spawning areas, located in Lower Big Creek, Upper Big Creek, and Monumental Creek. No minor spawning areas have been identified for the population. All three major spawning areas are currently occupied, with distribution mirroring historic distribution. Thus, this population is rated at very low risk for spatial structure. This is adequate to attain the desired status for this population.

Diversity: From a limited number of samples, it appears that the Big Creek population may have low genetic diversity and may have lost some of its historic genetic diversity. The ICTRT (2009) gave the Big Creek population a moderate risk rating for diversity driven by the genetic variation score (metric B.1.c.). This diversity risk level needs to be lowered to attain the desired overall status for this population. However, as more genetic data becomes available, it is very possible the actual risk for the genetic variation metric will be revised to low or very low.

Summary: The Big Creek spring/summer Chinook population does not currently meet the desired status because the abundance/productivity risk is not suitable to meet the criteria for a very low risk population. A reduction in the level of risk related to abundance/productivity needs to occur before the population can reach its desired status.

The Big Creek spring/summer Chinook population is currently rated at moderate risk for the combined spatial structure and diversity risk. This is not adequate to attain the desired status of highly viable for the population. The risk is driven by the moderate risk assigned by diversity, which is influenced by a very limited number of samples. With additional sampling it is very possible the actual risk for the genetic variation metric will be revised to low or very low. This would reduce the combined spatial structure/diversity risk to low or very low, which would be suitable to attain the desired status.

Table 4.3-4 summarizes the abundance/productivity and spatial structure/diversity risks for the Big Creek population. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 4.3-4. Viable Salmonid Population parameter risk ratings for the Big Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	HR
	High (>25%)	HR	HR	Big Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the Big Creek population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 summarizes the regional-level factors that impact all Idaho Snake River spring/summer Chinook populations.

Natal Habitat

Habitat Conditions: The population occupies Big Creek and its tributaries. Nearly the entire population is contained within the Frank Church River of No Return Wilderness Area and managed by the U.S. Forest Service. Several privately owned parcels also exist in the watershed. Elevations in the Big Creek watershed range from about 3,400 feet at the confluence of Big Creek and the Middle Fork Salmon River to over 9,000 feet on some peaks. Much of the area consists of steep canyon lands that drain into Big Creek. Wildfire is a common disturbance. Big Creek has a snow dominated hydrologic regime with peak runoff occurring in May and June, a transition in July, and return to baseflow in August.

Wilderness recreation is the predominant use in this area. The upper portions of Big Creek and its tributary Monumental Creek have been influenced the most by human activity compared to other parts of the population area, primarily through mining and related activities such as road building and clearing of trees. Over 700 acres of land in upper Big Creek are privately owned in the Edwardsburg-

Big Creek town site. Another 160 acres of private land are at Mile-Hi, near Coxey Creek, and 525 acres of private land are in the Monumental Creek headwaters.

Current Habitat Limiting Factors: NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, identified in the following habitat descriptions, and on discussions with local fisheries experts and watershed groups, we conclude that the habitat limiting factors are those described below.

1. Low streamflows, passage barriers and fish entrainment due to water diversions.
Several water rights exist in the Big Creek drainage for irrigation, power generation, domestic use, and mining (IDWR 2009). The majority of the diversions are in the upper reaches of Big, Logan, Government, and Crooked Creeks (Figure 4.3-4). Cumulative water rights add up to approximately 9 percent of modeled August low flows for Big Creek[1], indicating that water diversions may have only a small impact on habitat availability in the lower sections of Big Creek. However, in the upper tributaries where the diversions are located, water diversions may be reducing the amount of available habitat and limiting growth of juvenile spring/summer Chinook. In these reaches, maximum diversion rates account for 15-38 percent of modeled August low flows[2]. It is unknown whether these diversions leave adequate instream flow for spawning and rearing, allow for fish passage, or have screens in place to prevent fish entrainment in diversion ditches.

[1] Total diversions in Big Creek amount to approximately 7% and 9% of the August 50% and 80% exceedence flows (Q50 and Q80) calculated using StreamStats basin characteristics and equations (http://water.usgs.gov/osw/streamstats/).
[2] Total diversions in Big Creek, Logan Creek, Government Creek, and Crooked Creek amount to 28%, 36%, 15%, and 38% of potential August 80% exceedence flows for these creeks, respectively, calculated using StreamStats basin characteristics and equations.

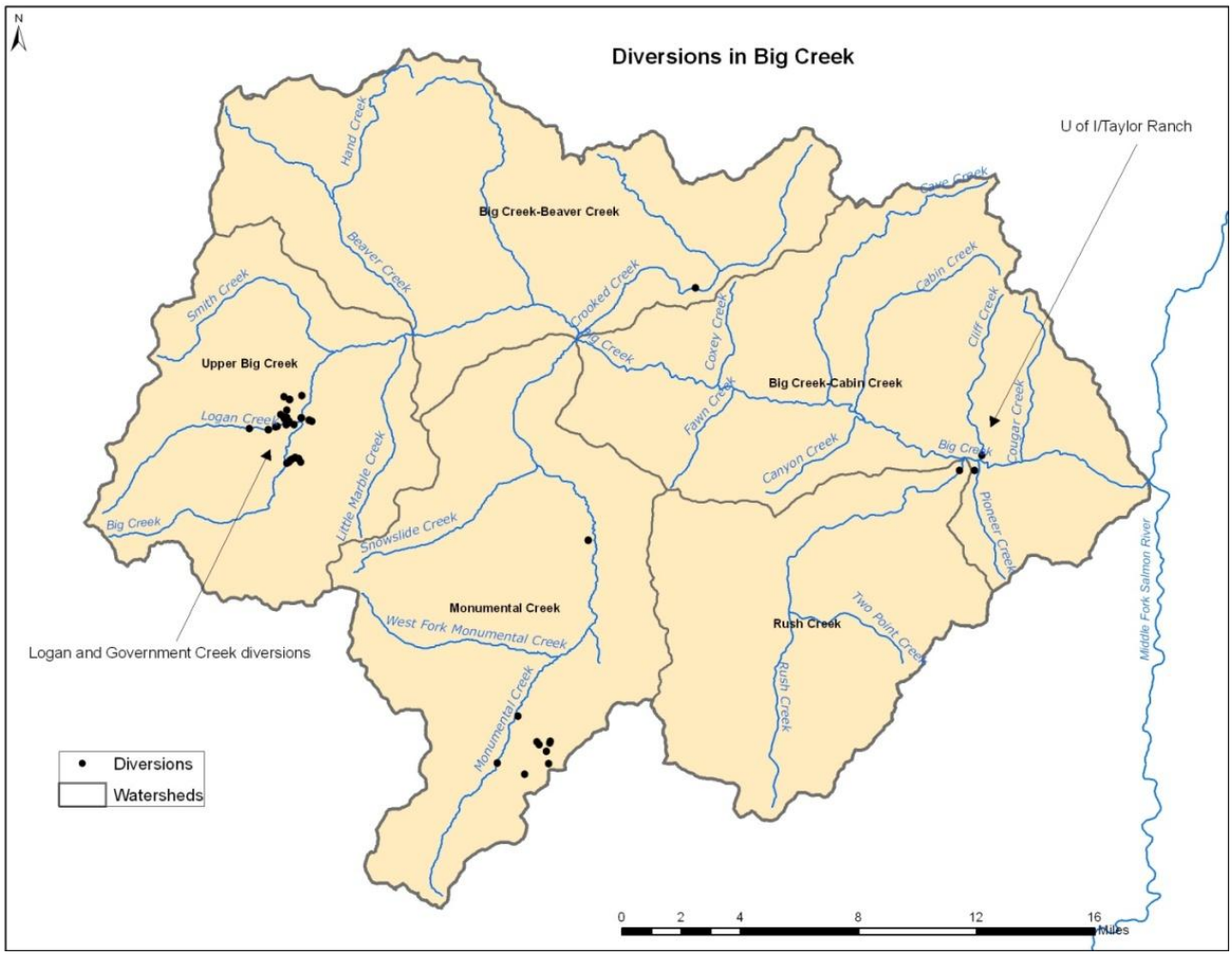

Figure 4.3-4. Diversion in the Big Creek watershed.

2. Excess sediment.

Most watersheds occupied by the Big Creek population are located in designated wilderness areas. With the exception of small reach-scale, localized anthropogenic disturbance, these watersheds have primarily not been degraded from reference condition and are considered pristine. However, localized portions of the Big Creek watershed have been affected by legacy mining and associated road development. The most significant occurrences are in Upper Big Creek and Monumental Creek, where habitat quality has been affected by accelerated sediment delivery and instream channel modification (USDA 2003a). Numerous placer and lode deposits were prospected and worked in the area, but most are abandoned now with the exception of Golden Hand, Velvet Quartz, Fourth of July, and Snowshoe Mines (Wagoner and Burns 2001). Upper Monumental Creek was previously identified on the Clean Water Act 303(d) list as impaired by sediment and metals (USDA 2003a), but since has been delisted (IDEQ 2008a). The Payette National Forest established a monitoring site on Mule Creek (tributary to Monumental Creek) to monitor the immediate effects of the Thunder Mountain Mines, specifically the Dewey Mine and discharge into Monumental Creek by way of Mule Creek. This site has consistently shown an apparent downward trend in cobble embeddedness (Nelson and Burns 2005).

Spring/summer Chinook spawning is currently affected by a ford on Upper Big Creek. The native-surfaced, non-USFS-system road currently accesses private property and a USFS trailhead, negatively affecting spawning and rearing Chinook by disturbing and displacing spawning fish, altering hydrologic patterns, widening the stream channel, impacting streambank stability, and adding sediment to spawning gravels (Wagoner and Burns 2001).

3. Passage barriers due to roads and mining activities.
Only a few passage barriers exist within the Big Creek watershed, and these are mostly associated with roads and mining activities. Also, a defunct diversion dam originally associated with the Snowshoe Mine is located on Crooked Creek. The degree to which this dam may be blocking or inhibiting access to potential Chinook spawning habitat upstream is currently unknown.

4. Nutrient deficiency.
Pacific salmon and steelhead once contributed large amounts of marine-derived carbon, nitrogen, and phosphorus to freshwater ecosystems in the Pacific Northwest through the disintegration of spawned-out carcasses. Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (HSRG 2009).

No completed studies have tested whether a lack of marine-derived nutrients is limiting the productivity of Chinook in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in Big Creek.

1. New mineral exploration and development.

2. Spread of noxious weeds that can increase soil erosion and decrease native plant density.

3. Off-highway vehicle (OHV) use. Assuring that OHV use is restricted to existing USFS roads and trails will likely minimize impacts.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition

Current Predation Limiting Factor:

1. *Invasive species.*

Non-native brook trout are present in Big Creek. At a selection of sites in the Salmon River basin, including Big Creek, Levin et al. (2002) found that juvenile Chinook survival in streams without brook trout was nearly double the survival in streams with brook trout.

Brook trout may impact Chinook through several mechanisms. Brook trout are known to aggressively defend feeding territories and outcompete anadromous salmon (Hutchison and Iwata 1997). In some studies, competition between brook trout and Chinook parr appears related to the larger size of brook trout affecting growth rates and survival of juvenile salmon (Meekan et al. 1998; Einum and Fleming 2000), with brook trout outcompeting juvenile Chinook for limited food and habitat. On the other hand, Macneal et al. (2009) compared feeding behaviors and aggressive encounters between brook trout and juvenile Chinook in a watershed in the South Fork Salmon River subbasin and found minimal competition for prey. Another mechanism through which brook trout may impact Chinook is direct consumption; brook trout are voracious predators, frequently consuming juvenile salmonids (Sigler and Sigler 1987; Karas 1997). Brook trout also appear to be an important predator of salmon eggs (Karas 1997). For example, salmon eggs have been found to represent between 38 and 95 percent of the diet of brook trout in a tributary to Lake Ontario (Johnson and Ringler 1979; Johnson 1981). Finally, increasing numbers of brook trout could be in part due to replacement, with brook trout becoming more established in areas historically occupied by native species as the native species' population numbers fall and habitat conditions worsen (Dunham et al. 2002).

Through snorkel surveys, Idaho Department of Fish and Game has observed brook trout to be common in Big Creek since 1984 when surveys began (IDFG 2010), but it is not know how common the species was before this time. Thus, it is not known how long the presence of brook trout has potentially been affecting the Big Creek population. Removal of brook trout may be a consideration for long-term improvements in Chinook abundance/productivity in the Big Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to Chinook populations. IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest.

Recovery Strategies and Actions

The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a highly viable status.

1. Identify and rehabilitate abandoned mined lands and roads to reduce impacts to water quality and fish habitat for listed fish species.

2. Review of existing water rights and diversions to assure there are no barriers to fish passage, screening is adequate to prevent mortality, and remaining instream flows are adequate.
3. Review existing fords to assure that impacts to habitat are minimized.
4. Investigate if nutrient supplementation can be used to boost productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

The Big Creek habitat portion of the recovery plan will be implemented by the Payette National Forest, IDWR, IDFG, and Nez Perce Tribe. These parties have a record of implementing salmon conservation projects and programs in this drainage and in other areas within the state. The Payette National Forest is responsible for OHV use on USFS land, grazing on USFS land, and diversion of water on or across USFS land in the Big Creek drainage. The Idaho Department of Water Resources administers the water acquisition program that rents or purchases water rights to improve fish habitat. Idaho Department of Fish and Game is responsible for management of fisheries in the Big Creek drainage. The Nez Perce Tribe is actively pursuing habitat restoration projects with Payette National Forest in this watershed. Big Creek is a priority area for restoration for the Payette National Forest, and the Forest is currently in the analysis and planning phase for restoration work in the watershed. Table 4.3-5 identifies limiting factors, proposed actions, priority locations, projects and associated costs for recovery of the Big Creek population.

Habitat Cost Estimate for Recovery

The Nez Perce Tribe has proposed mine rehabilitation and riparian restoration projects, listed in Table 4.3-5. These projects were included among the FCRPS habitat actions. The cost of these projects, should they be implemented, would be $295,000 in the first year. The Forest Service is pursuing this funding as an annual amount for the next 10 years, which would result in $2,950,000 dollars being spent in the watershed. The cost of the road decommissioning and culvert replacement projects listed in Table 4.3-5 is currently unknown because these projects have not yet received funding.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

Predation/Competition Recovery Strategy and Actions

The following action is intended to improve productivity rates for Big Creek spring/summer Chinook by addressing impacts from brook trout.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

Table 4.3-5. Recovery Actions Identified for the Big Creek Spring/Summer Chinook Population.

Recovery Actions Identified for the Big Creek Spring/Summer Chinook Population.						
Natal Habitat Recovery Actions						
Assessment Unit (AU)	**Primary Limiting Factor(s) by AU**	**Necessary Actions**	**Actions/Projects - 2008 to 2018**	**Cost for Identified Projects**	**Actions/Projects Beyond 2018**	**Project Costs Beyond 2020**
Big Creek watershed	Chemical pollution/metals	Mine site rehabilitation; riparian area restoration	Mine rehabilitation and 5 acres of riparian restoration	Budgeted costs are $295,000 per year. This amount of funding is being sought annually from BPA for the next 10 years.	Unknown	Unknown
	Sediment	Reduce sediment by improving and decommissioning roads	5 miles of road decommissioning, 1 culvert replacement	Not yet funded (?)	Possible channel enhancement projects	Unknown
The Big Creek watershed has the potential to move from an estimated current status of 85% habitat function to 91% habitat function at the end of 10 years if the projects identified in Table 4.3-6 are funded and implemented. The identified budget is likely to result in less than a 1% improvement in habitat function if the mine rehabilitation and riparian restoration projects are only implemented for one year.						
Hatchery Recovery Actions						
Assessment Unit (AU)	**Primary Limiting Factor(s) by AU**	**Necessary Actions**	**Actions/Projects - 2008 to 2018**	**Cost for Identified Projects**	**Actions/Projects Beyond 2018**	**Project Costs Beyond 2020**
Harvest Recovery Actions						
Assessment Unit (AU)	**Primary Limiting Factor(s) by AU**	**Necessary Actions**	**Actions/Projects - 2008 to 2018**	**Cost for Identified Projects**	**Actions/Projects Beyond 2018**	**Project Costs Beyond 2020**
Predation/Competition Actions						
Assessment Unit (AU)	**Primary Limiting Factor(s) by AU**	**Necessary Actions**	**Actions/Projects - 2008 to 2018**	**Cost for Identified Projects**	**Actions/Projects Beyond 2018**	**Project Costs Beyond 2020**

4.3.6.2 Bear Valley Spring/Summer Chinook Population

Abstract/Overview

The Bear Valley spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring run Chinook. Its targeted desired status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Viable

Actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained and provide a small likelihood of achieving the viability target of viable. It is very likely that to attain viable status for this population, further actions will need to be taken besides those identified in this recovery plan.

The best remaining opportunities for additional improvement to Bear Valley Creek spring/summer Chinook survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake, and Columbia migration corridors. Some of these potential additional recovery actions may be identified and implemented in the near term. However, the major opportunity for identifying additional actions to increase survival will occur after the analysis of the information being collected during the 10-year term of the 2008 FCRPS Opinion, the U.S. v. Oregon Agreement, and the Pacific Salmon Treaty. The monitoring and research information collected during this 10-year period, particularly in the mainstem rivers, will provide a very important opportunity to re-evaluate the status of the species and will provide additional knowledge that will guide the next round of actions under this recovery plan.

Current best available information indicates that there is a small likelihood of achieving the desired status. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the desired status, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the Bear Valley Creek spring/summer Chinook population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population

Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The ICTRT (2003) distinguished Bear Valley Creek spring/summer Chinook as an independent population based on high genetic separation from Middle Fork Salmon River tributaries Marsh Creek and Camas Creek. The population contains spring-run fish.

The Bear Valley Creek population utilizes three major spawning areas (Lower Bear Valley Creek, Upper Bear Valley Creek, and Elk Creek) with a branched continuous C-Trellis type spawning complexity and no minor spawning areas. All three major spawning areas are located in one EPA level IV ecoregion (Southern Forested Mountains). All major spawning areas are considered to have high intrinsic potential for spring/summer Chinook spawning and rearing, and Chinook spawning redds are found in near equal proportion in all three major spawning areas. All historic spawning areas, modeled by the ICTRT as intrinsic potential, are currently occupied, such that there has likely been no loss of historic habitat (ICTRT 2009). Spawning occurs primarily in West Fork Elk Creek, Elk Creek, and Bear Valley Creek upstream of Fir Creek. In addition to these stream reaches and to the potential habitat delineated by the ICTRT's intrinsic potential model (Figure 4.3-5), spawning and rearing is also known to occur in the lower sections of Bearskin, Casner, Cub, Mace, Sheep Trail, Cache, Sack, Pole, Wyoming, Cold, and Fir Creeks.

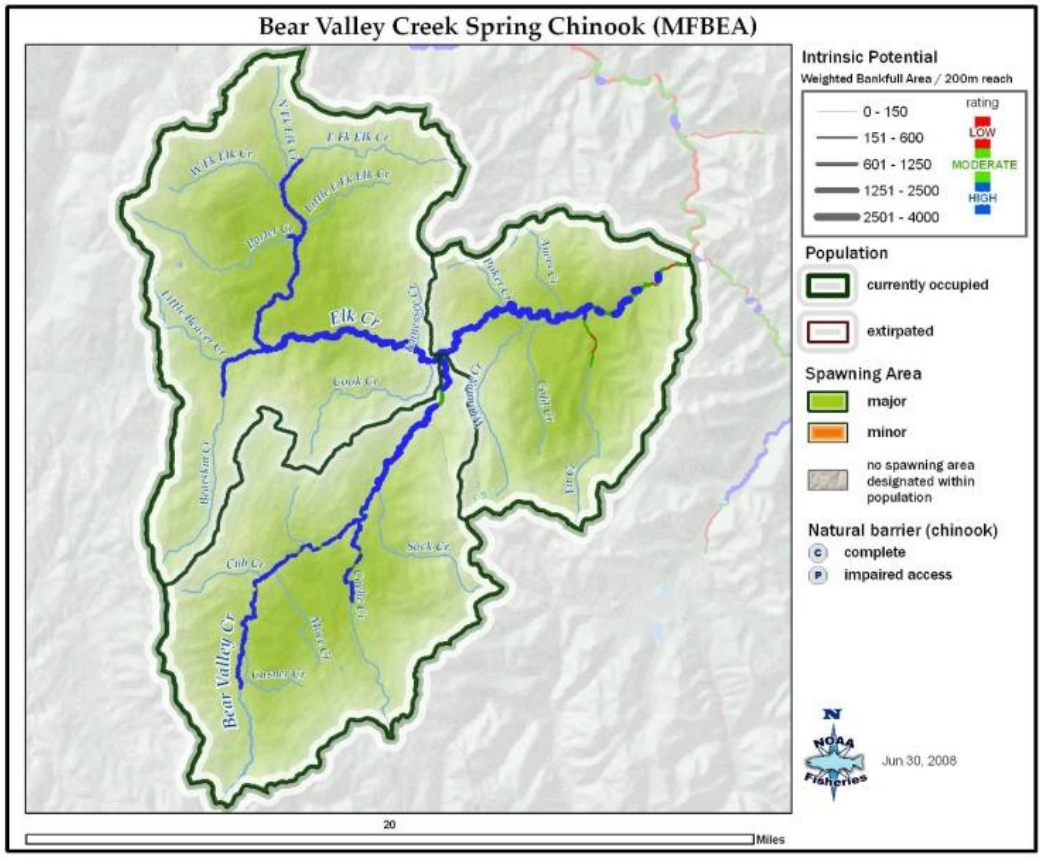

Figure 4.3-5. Bear Valley Creek Spring Chinook Population.

Abundance and Productivity: As an intermediate-sized population, viable status for Bear Valley Creek can be achieved with a mean minimum abundance of 750 natural-origin spawners at a productivity of 1.76 recruits per spawner. In contrast, the recent (2000-2009) 10-year geometric mean adult spawner abundance was 363 fish. The 10-year mean delimited recruit per spawner point estimate for the same period was 1.23 (Ford et al. 2010). All returning adults are natural spawners with no hatchery strays observed in the watershed.

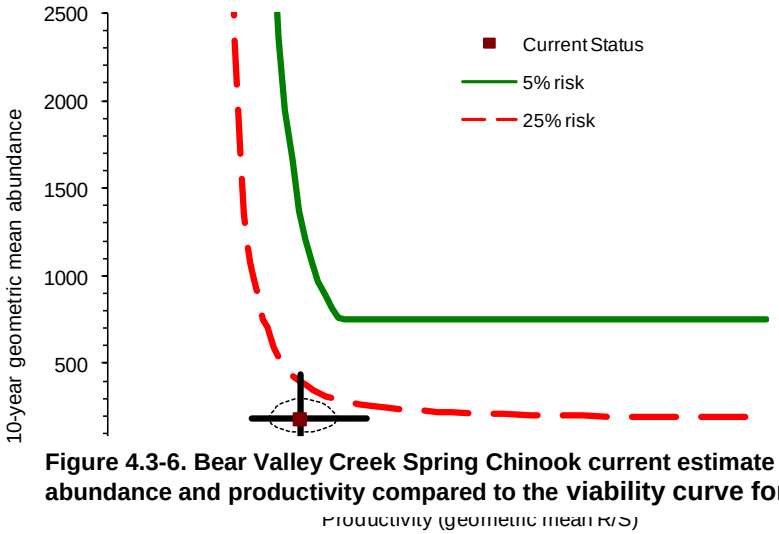

Figure 4.3-6. Bear Valley Creek Spring Chinook current estimate of abundance and productivity compared to the viability curve for

Productivity (geometric mean R/S)

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance and productivity that correspond to a particular risk level. The desired risk level for the Bear Valley Creek population can be attained with any combination of abundance and productivity that is above the green line shown in Figure 4.3-6.

Spatial Structure: In the Bear Valley Creek population, all three major spawning areas are occupied, such that current distribution mirrors historical range. All three of the ICTRT's spatial structure risk metrics are rated very low risk. Thus spatial structure risk does not preclude the population for attaining its desired status.

Diversity: All of the ICTRT's diversity matrices are rated low risk or very low risk and are suitable for the population to attain is desired status.

Summary: The Bear Valley Creek spring/summer Chinook population is currently rated high risk. The current rating is driven by a high risk rating for abundance/productivity. Without survival increases that lead to increases in abundance and productivity, the Bear Valley Creek population cannot reach its desired status of low risk. The Bear Valley Creek spring/summer Chinook population combined spatial structure and diversity is rated as low. The low risk rating for spatial structure/diversity is adequate to attain the desired status for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-6. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-6. Viable Salmonid Population parameter risk ratings for the Bear Valley Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

Abundance/ Productivity Risk	Spatial Structure/Diversity Risk: very low	low	moderate	high
very low (<1%)	HV	HV	V	M
low (1-5%)	V	V	V	M
moderate (6–25%)	M	M	M	HR
high (>25%)	HR	Bear Valley Creek	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: Bear Valley Creek is a tributary of the Middle Fork Salmon River. The Bear Valley Creek watershed has a mean elevation of 7,080 feet. It falls within the Southern Forested Mountain ecoregion and drains an area of 192 square miles. The entire watershed is managed public national forest, with 62 percent inventoried roadless area and 31 percent of its area within the Frank Church River of No Return Wilderness.

Bear Valley Creek has a natural snow and rain hydrologic regime. The basin receives approximately 30 inches of precipitation annually, the majority falling as snow throughout the winter. Snow melts into runoff or groundwater recharge from late April through early July with a characteristic peak streamflow occurring in late May to early June. Bear Valley riparian areas have sandy soils formed from deep colluvial, alluvial, and glacial deposits that receive water throughout the year from upland deep seepage and interflow. Estimated bankfull and base flow discharges at the Bear Valley gage (USGS 13309000) are 1,890 cfs and 107 cfs (IDEQ 2008).

Stream gradients in Bear Valley Creek create a critical link between watershed hydrology, historic land use, and salmon habitat degradation due to sedimentation. Approximately 41 percent of watershed streams are steep gradient, source areas where sediments are entrained, 47 percent are low gradient depositional reaches in the valley bottoms (meadows), and 12 percent are considered transport reaches capable of removing, without adding to, sediment loads. Depositional reaches will rely on high flows over time to remove excess sediment.

Spring Chinook habitat is affected by the primary current and past land uses in the watershed including dispersed recreation, road building, livestock grazing, timber management, dredge mining, and watershed restoration. Localized impacts to watershed conditions have occurred in the form of accelerated sediment delivery, stream channel modification, streambank degradation, passage barriers, and non-native fish species (USDA 2003).

Current Habitat Limiting Factors: NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, identified in the following habitat descriptions, and on discussions with local fisheries experts and watershed groups, we conclude that the habitat limiting factors are those described below.

1. Excess sediment.
In their 2008 Integrated Water Quality Monitoring and Assessment Report, IDEQ found that the majority of stream reaches in Bear Valley Creek (84.24 miles) did not have water quality problems and fully supported beneficial uses. However, IDEQ listed Bear Valley Creek from Cache Creek to Elk Creek (11.24 miles) as impaired by sediment and Bear Valley Creek from Elk Creek down to the Marsh Creek confluence (7.36 miles) as impaired by both sediment and high temperature. Bear Skin Creek (1.83 miles) was also listed as impaired by sedimentation (IDEQ 2008a).

Excess sediment has entered the basin primarily through two sources: first, erosion of sediment tailings from dredge mining in upper Bear Valley Creek in the late 1950s; and second, removal of stabilizing vegetation and bank erosion caused by grazing on Bear Valley and Elk Creeks and their tributaries. Roads are not a significant source of sediment. Sediment entrainment from past mining overburden and stream bank erosion, in conjunction with low stream gradients with limited capacity for transporting the legacy sediments, have reduced pool habitat and left spawning gravels impaired by fine sediments (IDEQ 2008b).

In 1989, the Shoshone-Bannock tribe completed rehabilitation of the mining areas and by 2001 all grazing allotments had been purchased and retired. Both of these efforts were funded by the Bonneville Power Administration. Recent rehabilitation efforts by the U.S. Forest Service, Idaho Department of Fish and Game, Trout Unlimited, Borah High School, and NMFS, including bank stabilization and road maintenance, have further reduced excess sediment inputs. With the rehabilitation efforts and reduction of threats, instream sediment conditions are improving (IDEQ 2008b).

On July 22, 2008, severe thunderstorms dropped over half an inch of rain in two hours over the Bear Valley Watershed, washing large amounts of ash and fine sediment into Bear Valley and Elk Creeks and their tributaries. Most of the sediment originated from the 2006 Red Mountain fire and the 2007 Sheep Trail fire area. Stream reaches most impacted were Bear Valley Creek from Sack Creek to Fir Creek, and Elk Creek from Little Beaver Creek to the confluence with Bear Valley Creek. Baseline sediment conditions were expected to degrade for a period of one year, or until the next spring runoff, with no effects expected beyond this time frame (USFS 2008).

Habitat conditions prior to the recent fire activity had shown measureable habitat improvements. Physical and biological surveys conducted in 2004 and 2007 by IDEQ's Beneficial Use Reconnaissance Program (BURP) teams documented positive changes in one section of upper Bear Valley Creek (Reach ID17060205SL012_03 in Figure 4.3-7). This reach was previously the greatest source of excess sediment in Bear Valley Creek because of historic dredge mining and a failed reclamation attempt in the 1960s (IDEQ 2008b). The BURP teams found surface fines of 20-23 percent and bank stability of 97 percent, both comparable to reference levels and no longer considered to be contributing excess sediment to this or lower gradient downstream reaches. Width-to-depth ratios were higher than reference, indicating that Bear Valley Creek is wider and shallower than

pristine streams. In addition, through 2004, the number of Chinook redds and macroinvertebrates showed an upward trend. Although difficult to quantify, these data suggest that restoration efforts and a reduction in surface fines have led to increased spawning and rearing habitat with possible gains in Chinook abundance and productivity.

Due to the improving sediment conditions, it is likely that the impaired waters in the Bear Valley Creek watershed will attain water quality standards in a reasonable period of time using passive restoration. With U.S. Forest Service leadership this is a reasonable approach, and adaptive management supplemented with ongoing monitoring should be adequate to assure attainment of sediment reduction goals.

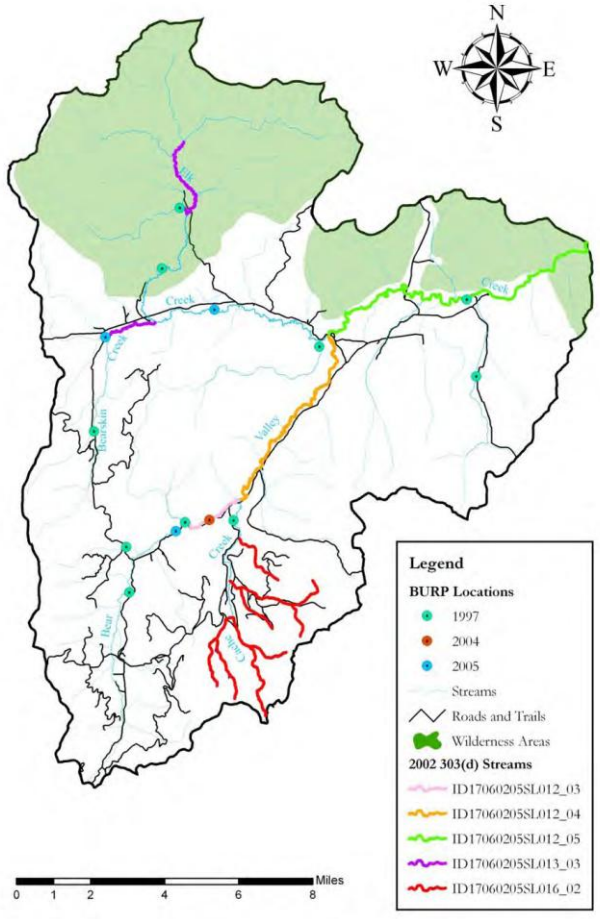

Figure 4.3-7. Bear Valley Watershed IDEQ Monitoring Sites (the reach with historic mining on upper Bear Valley Creek is shown in light pink) (IDEQ 2008b).

2. Degraded riparian and floodplain function.

In some degraded meadow areas, beaver populations and extensive pool complexes are likely less than optimal in terms of habitat function. Consideration should be given to increasing the beaver population in Bear Valley Creek. Beaver dams increase pool habitat, catch fine sediments, and raise water tables. Beaver ponds provide pool type juvenile rearing habitat capable of improving growth rates and overwinter survival in both anadromous and resident juvenile salmonids. In addition, these pools provide high water refugia (Pollock et al. 2003; Pollock et al. 2008). Beaver dams will raise

water tables extending riparian areas or helping re-establishing riparian vegetation which in-turn stabilizes streambanks. Raised water tables increase summer baseflows which increases available juvenile rearing habitat (Pollock et al. 2003). Beaver ponds catch silt and sand sediments resulting in stream bed aggredation. Aggredation will raise stream beds eventually reconnecting incised channels with floodplains, further increasing juvenile rearing habitat (Pollock et al. 2007).

3. Passage barriers.
In the past, culverts on Casner, Cub, Fir, and Sack Creeks did not allow fish passage, but all impassable culverts have now been replaced. In 2005, USFS and Valley County replaced culverts on Casner and Cub Creeks to allow fish passage (IDEQ 2008). The USFS replaced a culvert on FS Road 579 at Fir Creek with a bridge in 2009, and replaced three culverts on FS Road 582 at Sack Creek with a bridge in 2010.

4. Nutrient Deficiency.
Pacific salmon and steelhead once contributed large amounts of marine-derived carbon, nitrogen, and phosphorus to freshwater ecosystems in the Pacific Northwest through the disintegration of spawned-out carcasses. Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (Hatchery Scientific Review Group 2009).

No completed studies have tested whether a lack of marine-derived nutrients is limiting the productivity of spring/summer Chinook in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Bear Valley Creek watershed. One concern identified for this drainage is the spread of noxious weeds that can increase soil erosion and decrease native plant density. This concern should be managed so that habitat in Bear Valley Creek can continue to recover.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition
Current Predation Limiting Factors:
1. *Invasive species.*
Non-native brook trout are present in Bear Valley Creek. At a selection of sites in the Salmon River basin including Bear Valley Creek, Levin et al. (2002) found that juvenile Chinook survival in streams without brook trout was nearly double the survival in streams with brook trout. Currently, brook trout

occupy the mainstem upper and lower Bear Valley and Elk Creeks and most of their tributaries. Through snorkel surveys, Idaho Department of Fish and Game has observed brook trout to be common in Bear Valley Creek since 1984 when surveys began (IDFG 2010), but we do not know how common the species was before this time. Thus, we do not know for how long the presence of brook trout has potentially been affecting the Bear Valley Chinook population. The limiting factors discussion in Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions

The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Protect existing habitat to allow sediment levels and bank stability to return to reference conditions over time and to prevent any new degradation that could negatively affect abundance, productivity, or spatial structure.
2. Encourage additional beaver activity in the Bear Valley Creek watershed.
3. Consider nutrient enhancement to boost productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NMFS's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

Implementation of the habitat actions for this population will occur primarily through efforts of the USFS, interested tribes, and local stakeholder groups. Following the existing USFS Land and Resource Management Plan should provide the protection to habitat needed for this population. Idaho Fish and Game has management authority for fish and wildlife in this area. No short-term habitat projects have been identified for the Bear Valley Creek population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvement projects have been identified, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

Predation Recovery Strategy and Actions

The following action is intended to improve productivity rates for Bear Valley Creek spring/summer Chinook by addressing impacts from brook trout. The presence of brook trout is secondary to sediment issues. However, removal of brook trout may be a consideration for long-term improvements in spring/summer Chinook abundance/productivity in the Bear Valley Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to Chinook populations. The IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

4.3.6.3 Chamberlain Creek Spring/Summer Chinook Population

Abstract/Overview

The Chamberlain Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring run Chinook. Its targeted desired status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Viable

Actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained and provide a small likelihood of achieving the viability target of viable. It is likely that to attain viable status for this population, further actions will need to be taken besides those identified in this recovery plan.

The best remaining opportunities for additional improvement to Chamberlain Creek spring/summer Chinook survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake, and Columbia migration corridors. Some of these potential additional recovery actions may be identified and implemented in the near term. However, the major opportunity for identifying additional actions to increase survival will occur after the analysis of the information being collected during the 10-year term of the 2008 FCRPS Opinion, the U.S. v. Oregon Agreement, and the Pacific Salmon Treaty. The monitoring and research information collected during this 10-year period, particularly in the mainstem rivers, will provide a very important opportunity to re-evaluate the status of the species and will provide additional knowledge that will guide the next round of actions under this recovery plan.

Current best available information indicates that there is a small likelihood of achieving the desired viable status. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the desired status, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the Chamberlain Creek spring/summer Chinook population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population

Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The population extends along the main Salmon River from Chamberlain Creek downstream to the South Fork Salmon River and consists of spring-run fish returning to one major spawning area and three minor spawning areas (Figure 4.3-8). Although intermediate in size based on historical habitat potential, this population may be treated as "basic" for abundance and productivity criteria due to core area considerations (ICTRT 2009). Because much of the potential habitat is outside of the population's single major spawning area, the minimum abundance threshold has been adjusted downward to reflect a more realistic biological scenario. A Chinook population classified as basic has a mean minimum abundance threshold criteria of 500 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5 percent or less risk of extinction over a 100-year timeframe.

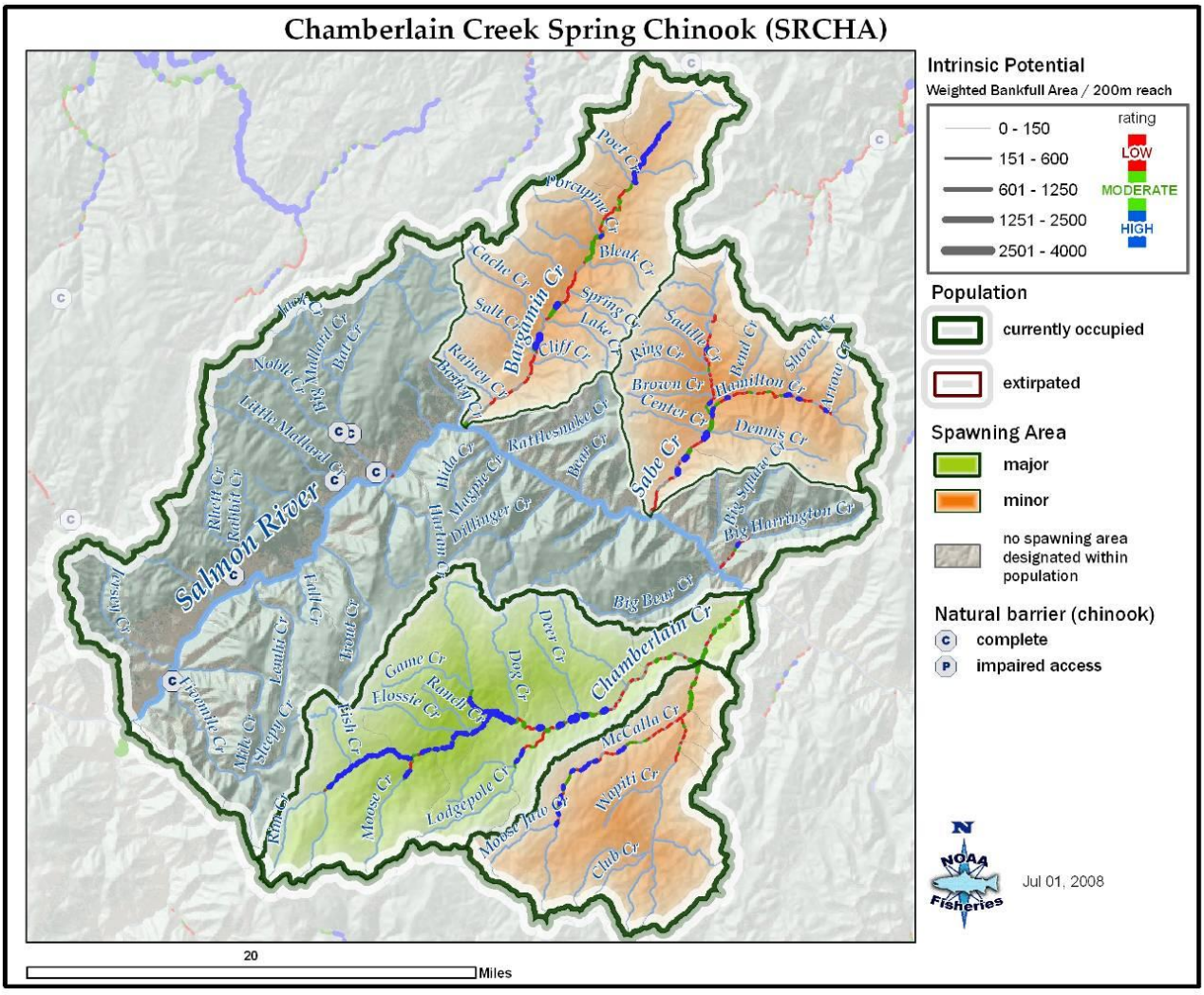

Figure 4.3-8. Chamberlain Creek spring/summer Chinook population.

The Chamberlain Creek population falls in a significant geographic position, providing connectivity between three MPGs (South Fork Salmon River, Middle Fork Salmon River, and Upper Salmon River). This population also has unique, persistent genetic characteristics. The Chamberlain Creek population modeled historic distribution ("intrinsic potential habitat") is distributed across three EPA level IV ecoregions, with the Southern Forested Mountains being predominant. Current spawning, on the other hand, includes significantly more utilization of the Hot Dry Canyons ecoregion (ICRT 2009).

Abundance and Productivity: As seen in Figure 4.3-9, the desired risk level can be achieved with various combinations of abundance and productivity. For the Chamberlain Creek population, the desired viable status can be attained with any combination of abundance and productivity that is above the green line. As a basic-sized population, viable status for Chamberlain Creek can be achieved with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21 recruits per spawner.

In comparison, the recent (2000-2009) 10-year geometric mean adult spawner abundance for the Chamberlain Creek spring/summer Chinook population is 605 fish. Based on recent adult spawner recruit series, the 10-year recruit per spawner productivity estimate for the same period is 1.79 (Ford et al. 2010). The abundance/productivity risk for the population is currently rated as high.

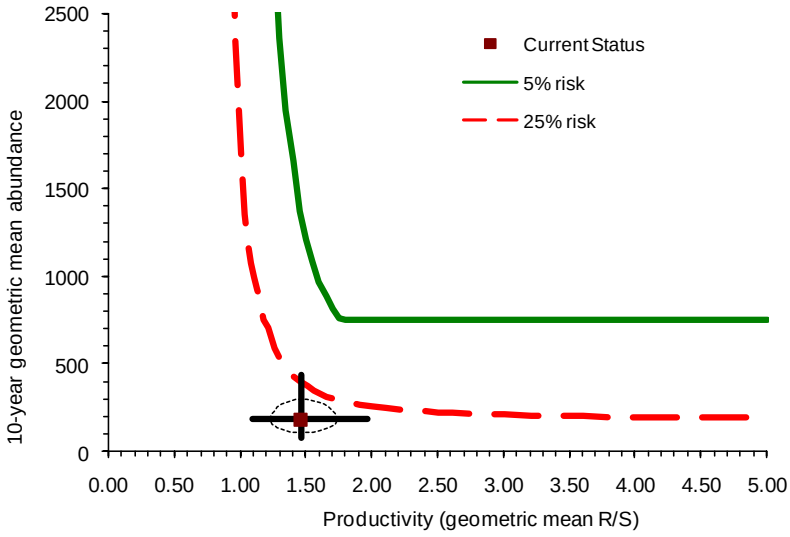

Figure 4.3-9. Chamberlain Creek spring/summer Chinook current abundance and productivity.

Spatial Structure: The ICTRT has identified one major spawning area and three minor spawning areas within the Chamberlain Creek spring/summer Chinook population. The limited number, size, and spatial arrangement of spawning areas give the population an inherent moderate risk. This risk is tempered by the fact that all of the spawning areas are occupied, leading to an overall moderate risk rating for spatial structure. Moderate spatial structure risk is adequate for the population to attain its desired viable status.

Diversity: There was adequate genetic information available to assign a very low risk rating to this population. Currently the Chamberlain Creek spring/summer Chinook population is at low diversity risk because of adequate genetic structure and the lack of hatchery influence.

Summary: The Chamberlain Creek spring/summer Chinook population does not currently meet viability criteria because abundance/productivity risk is high. The combined spatial structure/diversity risk is currently low and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-7. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-7. Viable Salmonid Population parameter risk ratings for the Chamberlain Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	HR
	High (>25%)	HR	Chamberlain Creek	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: The Chamberlain Creek population occupies Chamberlain Creek and its tributaries and the mainstem Salmon River and tributaries between Chamberlain Creek and the South Fork Salmon Mainstem population. Nearly the entire population is contained within the Frank Church River of No Return Wilderness Area. Most of the watershed is managed by the U.S. Forest Service, with small private inholdings.

With the exception of small, reach-scale anthropogenic impacts, these watersheds are generally not degraded from historical conditions (NMFS 2004). Outfitter/guide operation and recreation are the primary land uses, as ground-disturbing activities generally do not occur in Chamberlain basin. Recent U.S. Forest Service inspection reports of recreation camps noted few impacts to natural resources (Faurot 2007). The area is not roaded (Wagoner and Burns 2001). Although the fire regime closely resembles natural conditions, fire activity within the watershed during the last decade has burned reasonably large areas.

Recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage, with populations of spotted knapweed and rush skeletonweed posing the most potential to negatively impact habitat quality and quantity in the Chamberlain drainage (NPPC 2004). Based on recreation and trail use, the Payette National Forest has identified Middle Chamberlain, McCalla Creek, and Lower Whimstick Creek as subwatersheds that have an inherently high risk of weed establishment and spread (USDA 2003a).

Elevated water temperatures occur in streams in this population but are likely natural and not related to human causes (NPPC 2004). In the non-wilderness areas within the population boundaries, impacts to aquatic habitat include channel structure alterations, altered rearing habitats, altered hydrology and riparian areas, and chemical contamination from legacy mining (NPPC 2004). However, all current spawning and ICTRT-identified intrinsic potential for spawning and rearing are in the wilderness areas, so Chinook are likely not limited by any of these factors.

Current Habitat Limiting Factors: NMFS identified the following habitat limiting factor for the Chamberlain spring Chinook population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups.

1. *Nutrient Deficiency.*

Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (Hatchery Scientific Review Group 2009). No completed studies have tested whether a lack of marine-derived nutrients is limiting the productivity of Chinook in any of the Salmon River populations. However, watersheds in the central Idaho mountains are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat.

1. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

2. Degraded habitat function and water quality. Recreational use can impact riparian vegetation, increase sediment delivery, and spread noxious weeds.

Hatchery Programs

[Section to be developed]

Harvest Management

[Section to be developed]

Predation/Competition

Potential Predation Limiting Factors and Threats:

- Invasive species. Non-native brook trout have rarely been seen in the Chamberlain Creek spring/summer Chinook population boundaries (IDFG 2010), but are common in other watersheds in the Salmon River basin, and could spread to the Chamberlain Creek population at some point. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions

The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which specific projects have not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Consider nutrient enhancement to boost productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. Idaho Fish and Game has management responsibility for fish and wildlife in this area. No short-term habitat projects have been identified for the Chamberlain Creek population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat projects have been identified and funded, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

4.3.6.4 Marsh Creek Spring/Summer Chinook Population

Abstract/Overview

The Marsh Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring run Chinook. Its targeted desired status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Viable

Actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained and provide a small likelihood of achieving the viability target of viable. It is likely that to attain viable status for this population, further actions will need to be taken besides those identified in this recovery plan.

The best remaining opportunities for additional improvement to Marsh Creek spring/summer Chinook survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake, and Columbia migration corridors. Some of these potential additional recovery actions may be identified and implemented in the near term. However, the major opportunity for identifying additional actions to increase survival will occur after the analysis of the information being collected during the 10-year term of the 2008 FCRPS Opinion, the U.S. v. Oregon Agreement, and the Pacific Salmon Treaty. The monitoring and research information collected during this 10-year period, particularly in the mainstem rivers, will provide a very important opportunity to re-evaluate the status of the species and will provide additional knowledge that will guide the next round of actions under this recovery plan.

Current best available information indicates that there is a small likelihood of achieving the desired status. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the desired status, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the Marsh Creek spring/summer Chinook population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population

Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The ICTRT classified the Marsh Creek population as a "basic" population based on historical habitat potential (ICTRT 2005). The Marsh Creek population has a Branched Continuous C type spawning complexity. This population of spring Chinook has one major spawning area (Marsh Creek) and no minor spawning areas. This population contains spring run fish. The Marsh Creek population produces a relatively large number of juvenile migrants per spawner; however, due to the short growing season, size of juvenile migrants is small and they tend to have poor survival during mainstem river migration, including transportation in barges. The basic population information is shown in Figure 4.3-10.

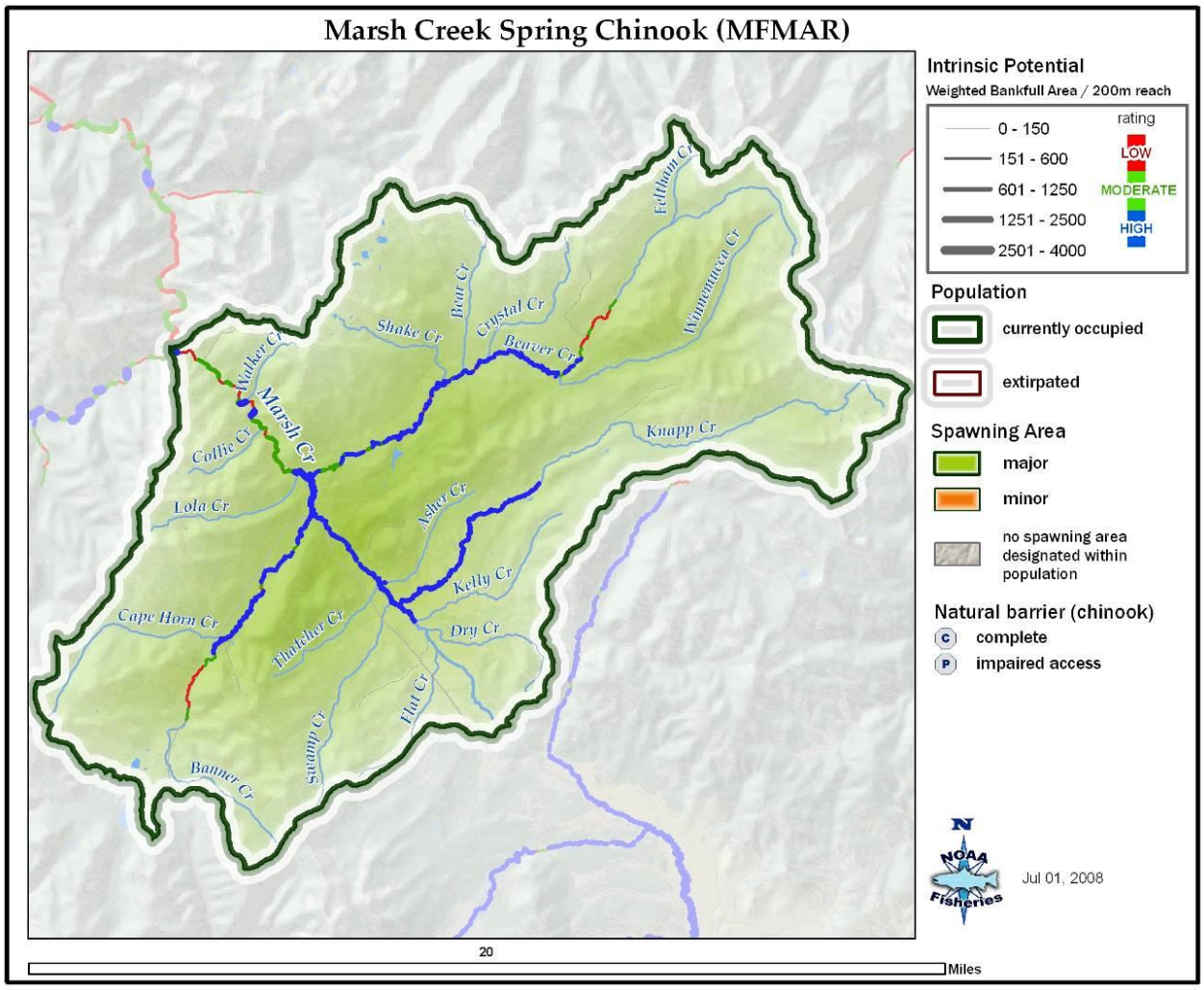

Figure 4.3-10. Marsh Creek Chinook population.

Abundance and Productivity: The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance and productivity that correspond to a particular risk level. Figure 4.3-11 shows how a particular risk level can be achieved with various combinations of abundance and productivity. For the Marsh Creek population, the desired status can be attained with any combination of abundance and productivity that is above the green line in Figure 4.3-11. As a basic-sized population, viable status for Marsh Creek can be achieved with a mean minimum abundance of 500 naturally produced spawners with a productivity of 2.21 recruits per spawner.

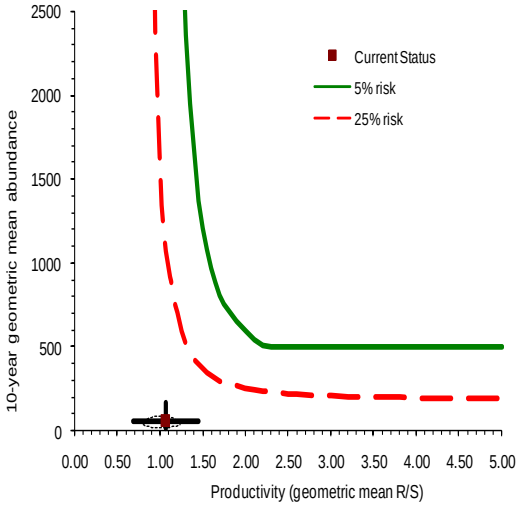

Figure 4.3-11. Marsh Creek abundance and productivity curve.

In contrast, the recent 10-year (2000-2009) geometric mean adult spawner abundance for the Marsh Creek spring Chinook population is 109 fish. Based on recent adult spawner recruit series, the 10-year recruit per spawner productivity estimate for the same period is 0.79, significantly less than the 2.21 productivity required at the minimum abundance threshold (Ford et al. 2010). The abundance/productivity risk for the population is therefore high and needs to be improved to attain the desired status for this population.

Spatial Structure: The Marsh Creek population of spring/summer Chinook consists of just one major spawning area (Marsh Creek), and this limited spatial structure creates some inherent risk for the population's viability. However, the total branched stream area is nearly the equivalent of two major spawning areas, with potential habitat distributed across several branches. Furthermore, current spawning distribution mirrors the historical range, and Marsh Creek is occupied at both the lower and upper ends based on recent spawner surveys. Therefore, overall spatial structure is rated at low risk. This is adequate to achieve the desired status for this population.

Diversity: All of the ICTRT's diversity matrices are rated low risk or very low risk and are suitable for the population to attain its desired status.

Summary: The Marsh Creek spring/summer Chinook population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Marsh Creek population cannot reach its desired status. The combined spatial structure risk/diversity risk is currently low and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-8. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-8. Viable Salmonid Population parameter risk ratings for the Marsh Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	HR
	High (>25%)	HR	**Marsh Creek**	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: The Middle Fork Salmon River starts at the confluence of Marsh and Bear Valley Creeks, making Marsh Creek one of the two upper most tributaries of the Middle Fork Salmon River. The Marsh Creek drainage encompasses 144 square miles and has a mean elevation of 7,490 feet, maximum elevation of 9,610 feet, and a minimum elevation of 6,140 feet at the confluence of Marsh and Bear Valley Creeks. Mean annual precipitation in the drainage is 28.5 inches, so it is relatively wet compared to most other Salmon River and Middle Fork Salmon River drainages. Most of the precipitation is in the form of snow, and peak streamflow usually occurs in late May or early June during the spring snowmelt. Streamflow gradually decreases from June through December with lowest flows occurring in January through March. Flows begin to increase in April when low elevation snow begins to melt. The growing season is short due to the high elevation so relatively little water is diverted for irrigation.

The U.S. Forest Service administers 99.6 percent of the drainage, and approximately 25 percent is in the Frank Church River of No Return Wilderness and is thus subject to very few human caused habitat impacts. The 75 percent of the drainage that is outside of the wilderness is subject to livestock grazing and off highway vehicle (OHV) use. Livestock grazing on USFS land is regulated and has been reduced since the 1990s but OHV use is unregulated, unmonitored, and is likely increasing. Forest management in the Marsh Creek drainage is mostly for resource protection and has little adverse impact on habitat in the short term, and may have long-term benefits.

Although historic mining and grazing degraded habitat throughout the Middle Fork Salmon River drainage (Peek 2000), habitat condition has since improved through natural processes. Habitat in the Marsh Creek drainage within the wilderness is considered to be in very good condition and is likely

stable or improving. Habitat in the non-wilderness sections of the drainage is subject to the land-uses described above. However, even with these impacts and potential threats, none of the streams in the Marsh Creek drainage are on the Clean Water Act 303(d) list and habitat is generally considered to be in very good condition.

Fish monitoring data for Marsh Creek tend to support the assumption that habitat is in good condition. Juvenile Chinook trapping data collected since 1994 indicate that egg to parr survival is very high. Juvenile Chinook have access to all suitable habitat in the Marsh Creek drainage. All suitable spawning habitat was occupied during 2001-2003 when the Marsh Creek population had more than 400 spawners each year. In contrast, during years when adults returning to Marsh Creek are less abundant, spawners are often absent from Knapp Creek. The number of juvenile Chinook migrating downstream from upper Marsh Creek and Knapp Creek is directly related to number of redds in those reaches (Figure 4.3-12). This relationship generally supports the assertion that habitat quality within the Marsh Creek drainage is very good.

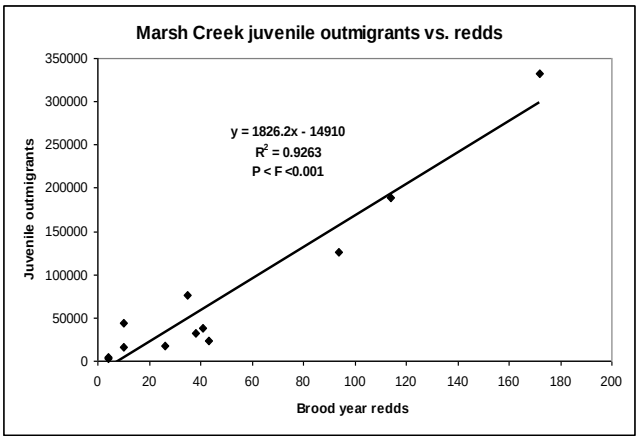

Figure 4.3-12. Marsh Creek juvenile outmigrants verus redds.

Improvements in habitat quality and availability are likely still possible and could increase population productivity. The Marsh Creek Chinook population is unique in the Middle Fork Salmon River major population group in that intensive monitoring of juvenile Chinook production (number and size of out-migrants) and downstream migration survival has been ongoing since 1994. Migration monitoring results suggest that survival from the juvenile trap in Marsh Creek to Lower Granite Dam, ocean survival, and overall population productivity are all related to size of out-migrants when they leave Marsh Creek (Figure 4.3-13). Monitoring results further suggest that size of out-migrants is dependent on population density and streamflow. Increases in habitat availability could reduce rearing density, which could lead to larger-sized out-migrants, which in turn could increase out-of-basin survival and overall population productivity. Increases in habitat availability might come from more extensive beaver pond complexes or from increased access to riparian wetlands.

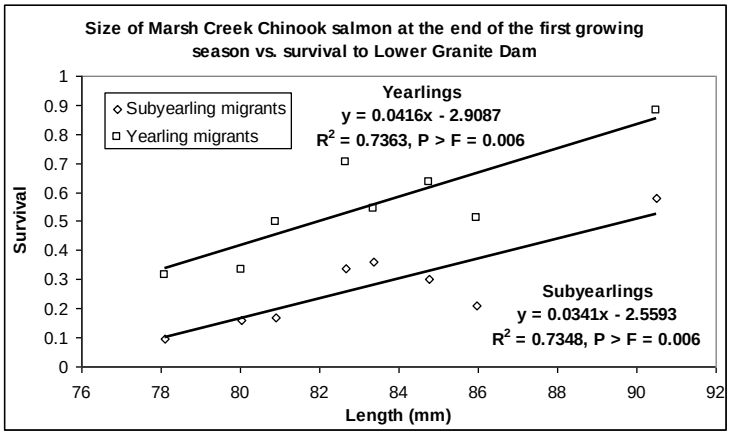

Figure 4.3-13. Size of juvenile Chinook outmigrants versus survival in the migration corridor.

Current Limiting Factors and Threats: NMFS identified the following habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups.

1. Degraded riparian and instream habitat.
The 75 percent of the Marsh Creek drainage that is outside of designated wilderness is subject to a variety of uses that could impact fish habitat (NPPC 2004). Grazing on USFS lands in the Marsh Creek drainage has been reduced since the 1990s; however, grazing still causes visible impacts to upland and riparian habitat. The OHV use also impacts riparian habitat. Although road density in the Marsh Creek drainage is low, roads run along most of the length of Marsh Creek and several tributaries, and there are numerous culverts on tributary streams that could adversely affect fish movement.

2. Low streamflows.
There are two irrigation water rights on Knapp Creek with a combined maximum diversion rate of 13.97 cfs. Although it is likely that far less water is being diverted than this maximum amount, use of these water rights could cause substantial impacts to fish. Water diversions may not bypass adequate flows, provide fish passage, or have adequate screens in place.

3. Degraded riparian and floodplain function.
Extensive beaver pond complexes, which are indicative of pristine habitat, are not present in many meadows areas of the Marsh Creek drainage. As riparian habitat continues to recover from past habitat perturbations, beaver populations may recover, which could increase quantity and quality of Chinook rearing habitat. Consideration should be given to increasing the beaver population in Marsh Creek.

Beaver dams increase pool habitat, catch fine sediments, and raise water tables. Beaver ponds provide pool type juvenile rearing habitat capable of improving growth rates and overwinter survival in juvenile salmonids. In addition, these pools provide high water refugia (Pollock et al. 2003; Pollock et al. 2008). Beaver dams will raise water tables, extending riparian areas or helping re-establishing riparian vegetation which in-turn stabilizes streambanks. Raised water tables increase summer baseflows which increases available juvenile rearing habitat (Pollock et al. 2003). Beaver ponds catch silt and sand sediments resulting in stream bed aggredation. Aggredation will raise stream beds eventually reconnecting incised channels with floodplains, further increasing juvenile rearing habitat (Pollock et al. 2007).

4. Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting the productivity of spring/summer Chinook in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Marsh Creek watershed. Potential concerns identified for this drainage include:

1. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition
Current Predation Limiting Factors:

1. *Invasive species.*

Non-native brook trout are present in Marsh Creek. Brook trout currently occupy Marsh Creek and most of its tributaries. Through snorkel surveys, Idaho Department of Fish and Game has observed brook trout to be common in Marsh Creek since 1984 when surveys began (IDFG 2010), but we do not know how common the species was before this time. Thus, we do not know for how long the presence of brook trout has potentially been affecting the Marsh Creek Chinook population. Management of brook trout may be a consideration for long-term improvements in Chinook abundance/productivity in the Marsh Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to Chinook populations. The IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions
The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions
The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Work toward permanent acquisition of water rights on Knapp Creek so they can be applied to instream flow water rights.
2. Update ESA section 7 consultation on grazing allotments.
3. Encourage additional beaver activity in the Marsh Creek drainage.
4. Assure that OHV is restricted to existing USFS roads and trails.
5. Consider nutrient enhancement to boost productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

The Marsh Creek habitat portion of the recovery plan should be implemented by the Salmon-Challis National Forest, IDWR, and IDFG. The Salmon-Challis National Forest is responsible for OHV use on USFS land, grazing on USFS land, and diversion of water on or across USFS land in the Marsh Creek drainage. The Idaho Department of Water Resources administers the water acquisition program that rents or purchases water rights to improve fish habitat. Idaho Department of Fish and Game is responsible for management of fish and wildlife. These groups have a record of implementing salmon conservation projects and programs in this drainage and in other areas within the state. No short-term habitat projects have been identified for the Marsh Creek population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvements have been identified at this time, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

Predation/Competition Strategies and Actions

The following action is intended to improve productivity rates for Marsh Creek spring/summer Chinook.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

4.3.6.5 Loon Creek Spring/Summer Chinook Population

Abstract/Overview

The Loon Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted desired status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Viable

Actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained and provide a small likelihood of achieving the viability target of viable. It is likely that to attain viable status for this population, further actions will need to be taken besides those identified in this recovery plan.

The best remaining opportunities for additional improvement to Loon Creek spring/summer Chinook survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake, and Columbia migration corridors. Some of these potential additional recovery actions may be identified and implemented in the near term. However, the major opportunity for identifying additional actions to increase survival will occur after the analysis of the information being collected during the 10-year term of the 2008 FCRPS Opinion, the U.S. v. Oregon agreement, and the Pacific Salmon Treaty. The monitoring and research information collected during this 10-year period, particularly in the mainstem rivers, will provide a very important opportunity to re-evaluate the status of the species and will provide additional knowledge that will guide the next round of actions under this recovery plan.

Current best available information indicates that there is a small likelihood of achieving the desired status. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the desired status, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the Loon Creek spring/summer Chinook population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population

Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The ICTRT (2003) identified Loon Creek spring/summer Chinook as an independent population based on isolation and drainage size. The Loon Creek population is a Basic-sized population based on historic habitat potential, with a Branched Continuous C type spawning complexity. The population contains both spring and summer run fish, and consists of one major spawning area (Loon Creek) and no minor spawning areas.

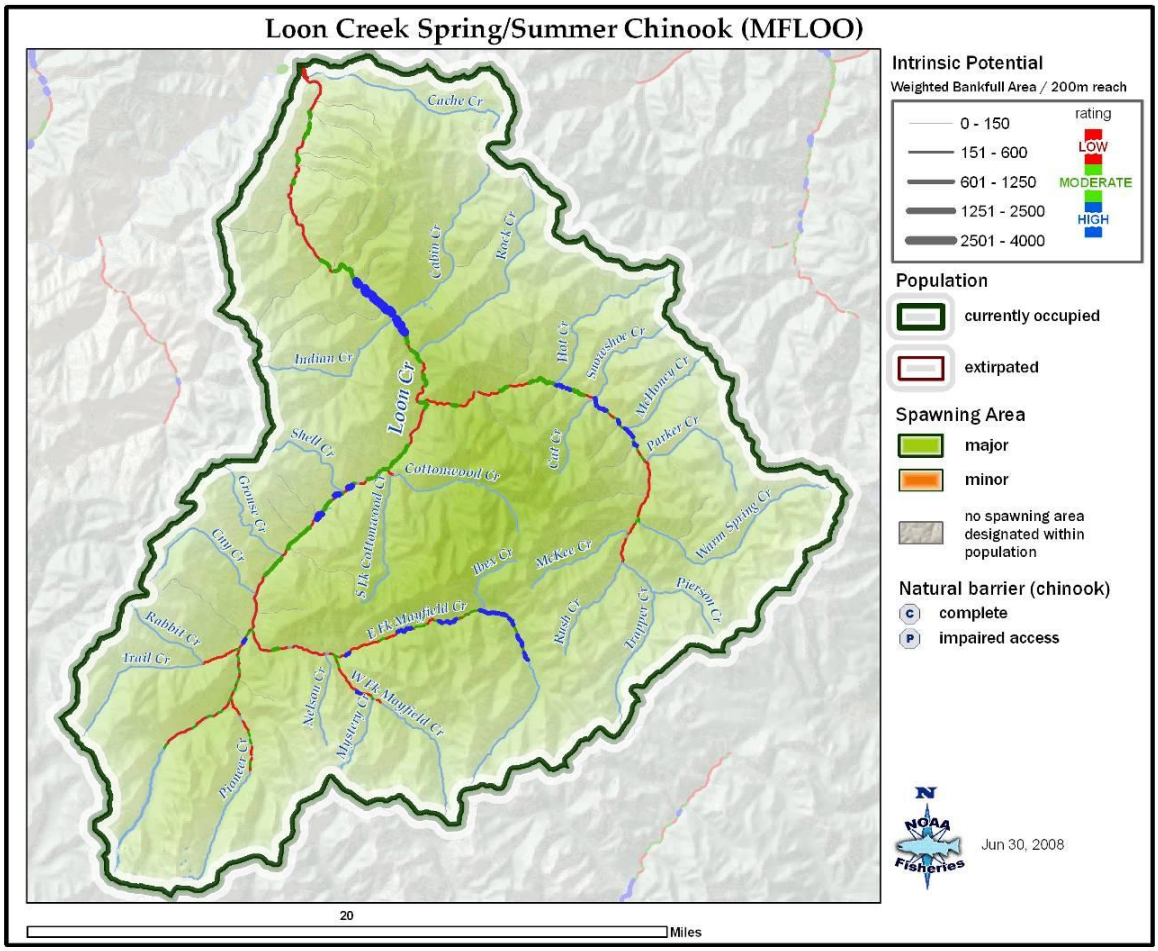

Figure 4.3-14. Loon Creek spring/summer Chinook population.

The Loon Creek population occupies Loon Creek and its tributaries (Figure 4.3-14) and is distributed across the Southern Forested Mountains EPA level IV ecoregion. The current distribution is nearly identical to the estimated historic distribution ("intrinsic potential" habitat in Figure 4.3-14) (ICTRT 2009).

Abundance and Productivity: The viability target abundance and productivity for this population is to achieve a mean abundance threshold of 500 naturally produced spawners with a productivity of 2.21

recruits per spawner. The recent 10-year (2000-2009) geometric mean adult spawner abundance for the Loon Creek spring/summer Chinook population is 67 fish. Based on the recent adult spawner recruit series, the 10-year recruit per spawner productivity estimate for the same period is 1.19, which is less than the 2.21 productivity required at the minimum abundance threshold (Ford et al. 2010). The cumulative abundance/productivity risk for the population is therefore high.

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance (measured as spawners) and productivity (measured as brood year spawner to spawner ratios) that correspond to a particular risk level. The Loon Creek population of Snake River spring/summer Chinook needs to be above the green line in Figure 4.3-15 to achieve low risk.

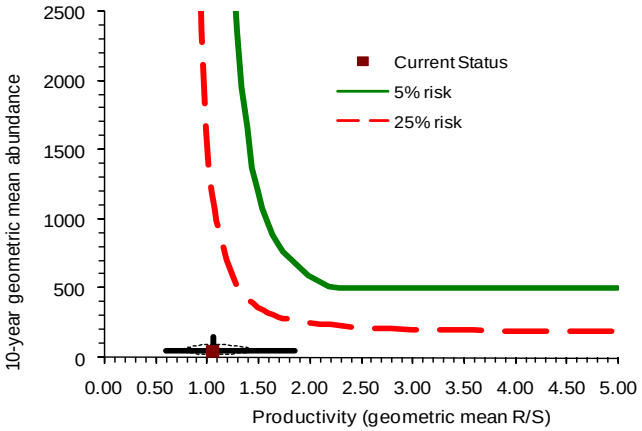

Figure 4.3-15. Loon Creek Spring /Summer Chinook abundance and productivity curve.

Spatial Structure: The Loon population consists of just one major spawning area (Loon Creek), and this limited spatial structure creates some inherent risk for the population's viability. However, the cumulative risk for spatial structure is tempered by the fact that the entire range of the population is still occupied. The cumulative risk for spatial structure is moderate risk, which is adequate for the population to achieve its desired status.

Diversity: The moderate diversity risk rating assigned to this population is driven by the genetic variation score, which in turn is influenced by a very limited number of samples. As more genetic data becomes available, it is very possible the actual risk for the genetic variation metric will be revised to low or very low. The moderate risk rating for diversity does not preclude the population from attaining its desired status.

Summary: The Loon Creek spring/summer Chinook population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Loon Creek population cannot reach its desired status of low risk. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-9. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-9. Viable Salmonid Population parameter risk ratings for the Loon Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	HR
	High (>25%)	HR	HR	**Loon Creek**	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the Loon Creek spring/summer Chinook population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: The Loon Creek population is located primarily in wilderness area watersheds generally considered pristine. However, portions of the Loon Creek drainage lie outside the wilderness area and have been degraded to various degrees by historic land use activities such as mining, grazing, logging, and road building (NPPC 2004). Most of the watersheds occupied by this population are highly functioning, but there is site-specific potential to improve habitat at road crossings, water diversions, and one mill site (NMFS 2004). Currently no waterbodies are identified on the Clean Water Act 303(d) list for this population.

As in other Middle Fork Salmon River watersheds, recreation use along trail corridors has likely led to the establishment and spread of noxious weeds in the drainage. Spread of noxious weeds has the potential to negatively impact habitat quality by altering riparian vegetation and increasing sediment inputs in Loon Creek.

There is one grazing allotment for 40 horses from June 1 through October 31 using a three-pasture rotation. The permittee has been in compliance with the permit and stubble height in late September exceeds four inches according to the annual report.

Water diversions exist in the Loon Creek population for power generation, domestic use, irrigation, and mining (IDWR 2009). The cumulative maximum diversion rate for these water rights is 14.20 cfs, far below estimated August low flows of 290 cfs at the mouth of Loon Creek[3]. It is therefore unlikely that water diversions are cumulatively reducing habitat availability in lower Loon Creek through

[3] As estimated using the StreamStats model, 50% of the time the August flow at the mouth of Loon Creek is greater than 290 cfs. (http://water.usgs.gov/osw/streamstats/)

reduced low; however, it is unknown if these diversions meet NMFS criteria for fish screens and passage.

There are historic mine sites in the area that may negatively impact fish habitat through chemical contamination or delivery of sediment to streams. For example, the abandoned Parker Mill, associated with past gold mining, is located directly adjacent to Warm Springs Creek, a tributary to Loon Creek. There is limited information on this site, other than that the mill utilized a cyanide vat leach process between 1905 and 1941 and that the site burned over in a wildfire in 2007 (Dean Morgan, USFS, pers. comm. 1/28/2010). This site may be contributing chemical contamination to Warm Springs Creek.

Current Limiting Factors and Threats: NMFS determined the habitat limiting factors for the Loon Creek population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. Based on this analysis, we conclude that habitat limiting factors for the Loon Creek spring/summer Chinook population exist, but are minor.

1.Passage barriers.
A push up diversion dam on the mainstem of Loon Creek at the Double D Ranch is a barrier to upstream fish passage and a partial barrier to downstream fish passage. This structure needs to be replaced, diversion rates reviewed, and appropriate screening completed.

2. Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting spring/summer Chinook productivity in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Loon Creek watershed. Potential concerns identified for this drainage include:

1. Water diversions. Existing water diversion structures should be reviewed to assure that appropriate fish screens are in place and that adequate water is left instream for fish passage.

2. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

3. Historic mine sites. Existing mine sites should be reviewed to assure they are not a source of sediment or hazardous materials into water bodies.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition

Potential Predation Limiting Factors and Threats:

1. Invasive species. Non-native brook trout have rarely been seen in the Loon Creek drainage (IDFG 2010), but are common in other parts of the Middle Fork Salmon River basin and could spread to Loon Creek at some point. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions

The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Replace the existing water diversion structure that is a barrier to fish passage on mainstem Loon Creek.
2. Consider nutrient supplementation to increase productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. Idaho Fish and Game has management authority for Fish and Wildlife in this area. No short-term habitat projects have been identified for the Loon Creek population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvements have been identified and funded, the cost estimate for habitat is zero for this population.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

4.3.6.6 Upper Middle Fork Salmon River Spring/Summer Chinook Population

Abstract/Overview

The Upper Middle Fork Salmon River spring/summer Chinook population includes the mainstem Middle Fork Salmon River and its tributaries above Indian Creek, as well as Marble Creek. The population supports spring run Chinook. The population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted desired status is to reach a level where it can be Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Maintained

Actions identified by this recovery plan to occur over the next 10 years should move this population's status to maintained.

Current best available information indicates that there is a high likelihood of achieving the desired status of Maintained. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the viability target, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The Upper Middle Fork Salmon River spring/summer Chinook population is an Intermediate sized population with a Branched Discontinuous C type spawning complexity. This population contains spring run fish, including one major spawning area (Middle Fork Salmon) and two minor spawning areas (Marble Creek and Upper Middle Fork Salmon). Most spawning and rearing occurs in the largest tributaries to the Middle Fork Salmon River, but some spawning also occurs in the mainstem Middle Fork Salmon River and small tributaries.

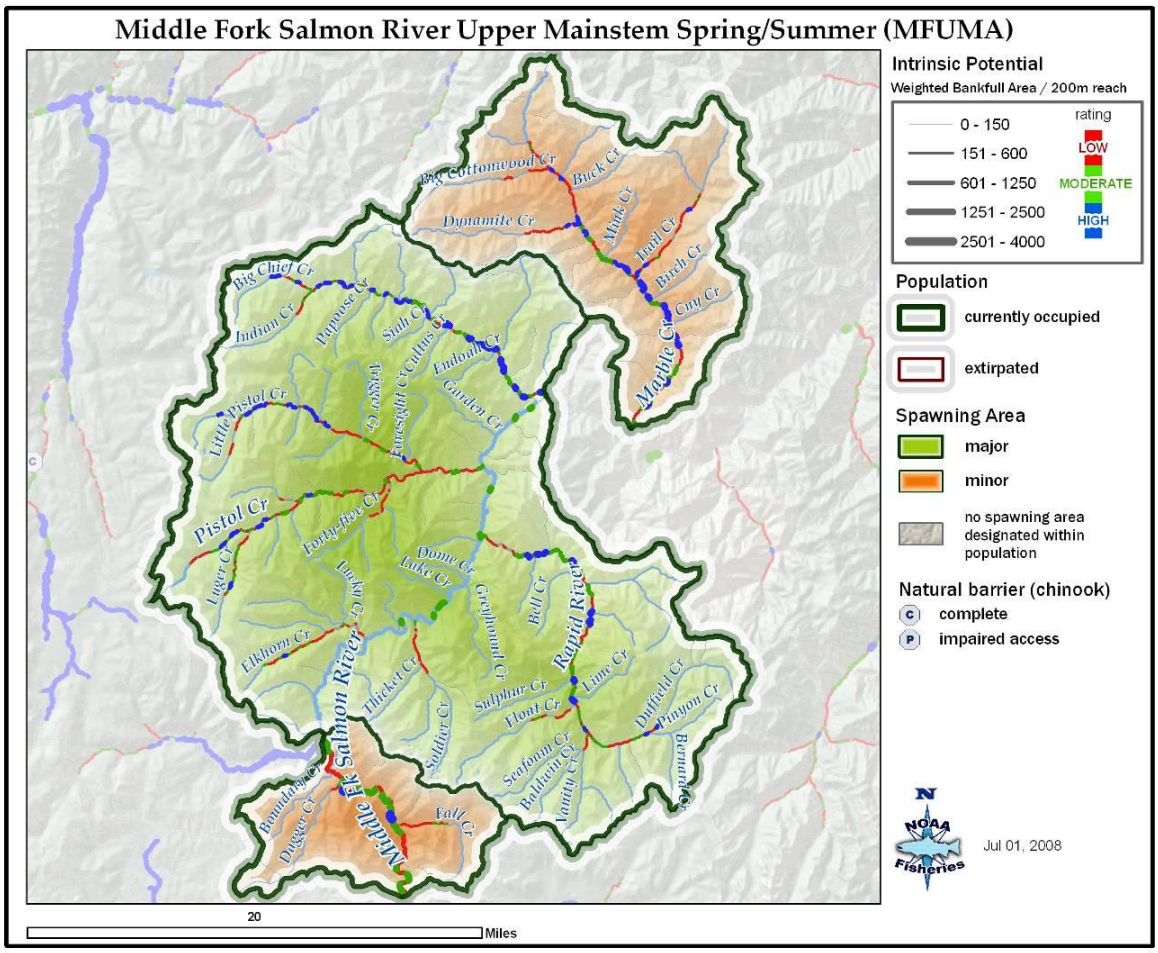

Figure 4.3-16. Upper Middle Fork Salmon River spring/summer Chinook population.

Abundance and Productivity: The ICTRT classified the population as intermediate, based on historical habitat potential (ICTRT 2003; 2005). The abundance and productivity viability targets for an intermediate sized population are to achieve a mean abundance threshold criteria of 750 naturally produced spawners with a productivity of 1.76. Currently, there is insufficient data available to calculate the standard trend metrics used for other populations so the abundance/productivity status is tentatively rated at high risk (Ford et al. 2010). This is consistent with the other populations in the Middle Fork Salmon River MPG where data was available to determine risk status. Therefore, a reduction of the abundance/productivity risk will need to occur before the population can achieve its desired status.

Spatial Structure: The Upper Middle Fork population consists of just one major spawning area and two minor spawning areas that add up to less than 75 percent of the capacity of a major spawning area. This limited spatial structure creates some inherent risk for the population's viability. This is partially offset by a low risk rating for the spatial extent of the population because current spawning distribution mirrors the historical distribution. These combine for a cumulative rating for spatial structure of low risk, which is adequate to attain the desired status for the population.

Diversity: The moderate diversity risk assigned to this population is driven by the genetic variation score, which in turn is influenced by an absence of data assessing genetic variation. It is very possible that the actual risk for the genetic variation metric is low or very low. The overall rating of moderate risk for this population does not preclude attainment of the desired status for this population.

Summary: The Upper Middle Fork spring/summer Chinook population does not currently meet viability criteria because the abundance/productivity risk is likely high. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its desired status. The cumulative spatial structure risk/diversity risk is moderate and this is adequate for the population of meet its desired status.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-10. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-10. Viable Salmonid Population parameter risk ratings for the Upper Middle Fork spring/summer Chinook population. The population does not meet population-level viability criteria.

Abundance/ Productivity Risk	Spatial Structure/Diversity Risk: Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	M
Low (1-5%)	V	V	V	M
Moderate (6 – 25%)	M	M	M ↑ Upper Middle Fork	HR
High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: Much of the Upper Middle Fork Salmon River population is located in designated wilderness, where most waterways are considered pristine. Due in large part to their remoteness and protected status, watersheds in the entire Middle Fork Salmon River drainage are not significantly impacted by habitat fragmentation associated with land uses, development, and habitat conversion (NPPC 2004). The 2008 Clean Water Act 303(d) list for the Upper Middle Fork Salmon River basin lists Elkhorn Creek as being impaired by sedimentation and high temperatures, but IDEQ subsequently found that conditions in the Elkhorn Creek watershed are comparable to wilderness conditions and recommended that Elkhorn Creek be delisted for sediment and temperature (IDEQ 2008b). The IDEQ

listed all other streams in the Upper Middle Fork population as wilderness waters or unassessed waters (IDEQ 2008a).

Although most habitat in the Upper Middle Fork population is in good shape, several minor impacts from human land uses have occurred. Legacy mining effects have contributed low levels of chemical contamination into Upper Marble Creek (Wagoner and Burns 1998). The protected status of the Upper Middle Fork has prevented the widespread impacts of grazing, but there are active sheep grazing allotments with identified impacts in the upper portions of the Upper Middle Fork watershed. However, measurements of rangeland condition in these watersheds indicate low to very low overall vulnerability to grazing impact (NPPC 2004). Timber harvest has been limited in the Upper Middle Fork, occurring on only 18 percent of the land base. Water rights exist for several small diversions for irrigation, mining, power, and domestic use on private land and USFS administration sites (IDWR 2009). Because the diversions are on streams without intrinsic potential for spring/summer Chinook spawning and rearing and all have maximum diversion rates of less than 1 cfs, impacts to spring/summer Chinook habitat are likely low. It is unknown whether these diversions are adequately screened.

Impacts from recreational use in the wilderness portions of the population are minimal and well controlled by existing regulations. Nonetheless, recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage, with populations of spotted knapweed and rush skeletonweed posing the most potential to negatively impact habitat quality and quantity in the Upper Middle Fork (NPPC 2004). The root systems of these and many noxious weeds lack the fibrous character of grasses, and fail to knit the soil together effectively. Areas with infestations by invasive, tap-rooted perennial weeds experience measurable increases in soil erosion (Lacey et. al. 1989; DeBaets et. al. 2007). Lacey et al. (1989) found that runoff and sediment yield were 56 and 192 percent higher, respectively, for plots dominated by spotted knapweed, rather than bunchgrass vegetation types.

In summary, streams in the wilderness sections of the Upper Middle Fork are well protected. In the non-wilderness portions of the Upper Middle Fork, streams are recovering from historic activities, such as mining, through passive restoration. These streams are largely upstream of tributary habitat with potential for Chinook.

Current Limiting Factors and Threats: NMFS determined the habitat limiting factors for the Upper Middle Fork Mainstem spring/summer Chinook population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. Based on this analysis, we conclude that habitat limiting factors for the population exist, but are minor.

Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting spring Chinook productivity in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Upper Middle Fork watershed. Potential concerns identified for this drainage include:

1. Water diversions. It is unknown whether the handful of small water diversions in the Upper Middle Fork population bypass adequate flows, provide for fish passage, and have adequate screening in place.

2. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on USFS grazing allotments remain current should minimize any effects from grazing.

3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

4. Impacts from recreational use. Impacts to spring/summer Chinook habitat from recreational use are currently minimal but should continue to be monitored.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition
Potential Predation Limiting Factors and Threats
1. Invasive species. Non-native brook trout have rarely been seen in the Upper Middle Fork population (IDFG 2010), but are common in Bear Valley Creek and Marsh Creek, immediately upstream, and could spread eventually to the Upper Middle Fork. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions
The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions
The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Consider nutrient supplementation to increase productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions

Responsibility for implementation of the recovery plan for this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. Idaho Fish and Game has management responsibility for Fish and Wildlife. No short-term habitat projects have been identified for the Upper Middle Fork Salmon population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvement projects have been identified, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

4.3.6.7 Lower Middle Fork Salmon River Spring/Summer Chinook Population

Abstract/Overview

The Lower Middle Fork Mainstem spring/summer Chinook population occupies the Middle Fork Salmon River below Indian Creek to the confluence with the main Salmon River, and the main Salmon River downstream to Chamberlain Creek. The population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted desired status is Maintained, which requires that it have no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Maintained

Actions identified by this recovery plan to occur over the next 10 years should move this population to a maintained status.

Current best available information indicates that there is a high likelihood of achieving the desired status of Maintained. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the viability target, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The Lower Middle Fork Salmon River spring/summer Chinook population occupies the Middle Fork Salmon River from the confluence with the main Salmon River to Indian Creek, and the main Salmon River downstream to Chamberlain Creek (Figure 4.3-17). The major tributary on the main Salmon River is Horse Creek.

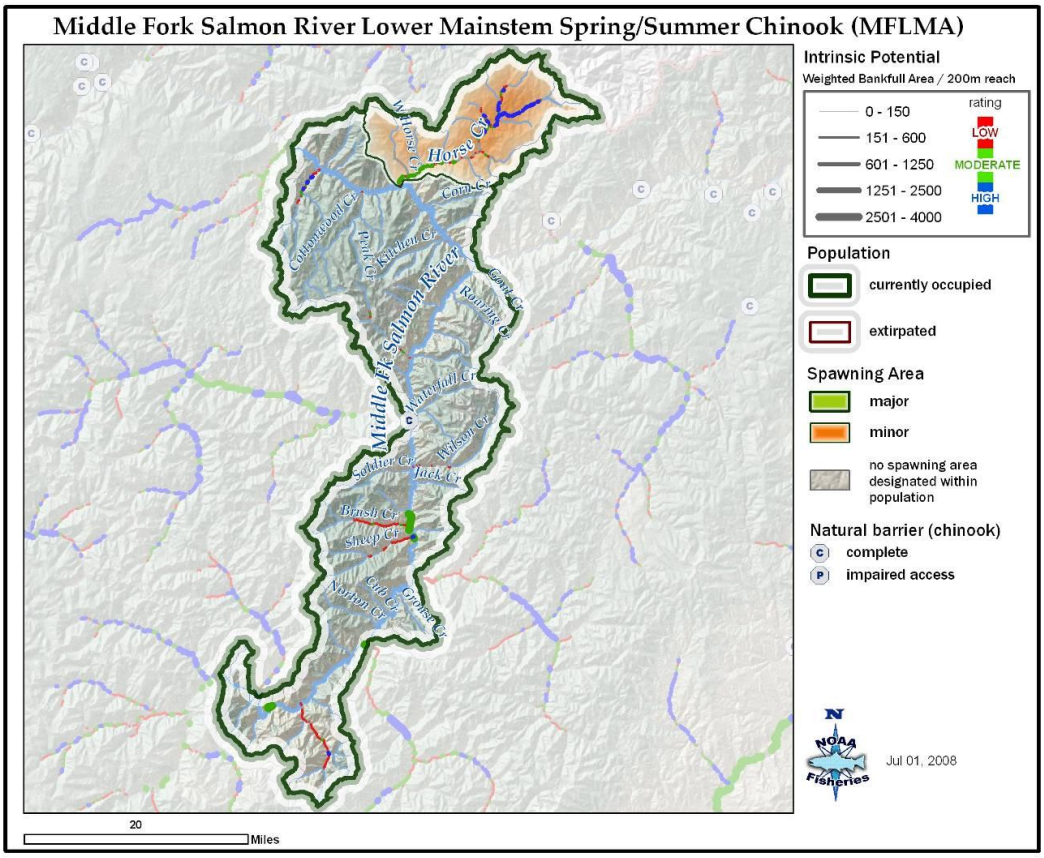

Figure 4.3-17. Lower Middle Fork Salmon River spring/summer Chinook population.

Spring and summer Chinook spawning in the Middle Fork Salmon River below Indian Creek were classified as an independent population based on isolation from spawning areas in tributaries to the Middle Fork Salmon River. Independence was supported by qualitative habitat differences (hydrology, temperature, elevation, and substrate). The ICTRT classified the Lower Middle Fork population as a Basic-sized population. Spawning within the population boundaries is primarily restricted to the mainstem Middle Fork Salmon River and Horse Creek. Tributaries to the mainstem rivers within this population typically are small and high gradient, although some provide limited amounts of suitable Chinook habitat. Horse Creek is the largest tributary in the population area and supports most of the recently documented spawning in the population (ICTRT 2009). This population likely historically supported both spring- and summer-run fish. Most of the mainstem river habitat in the population likely supported summer timed production, while upper tributary habitat likely supported more of a spring run timing.

The population's intrinsic potential habitat historically was distributed across one EPA level IV ecoregion (Southern Clearwater Forested Mountains – 100 percent). There is a substantial difference in estimated historic ecoregion occupancy and current occupancy as the population is now primarily distributed in the Hot Dry Canyons and Southern Forested Mountains ecoregions

Abundance and Productivity: The viability target abundance and productivity for this population is to achieve a mean abundance threshold criteria of 500 naturally produced spawners with a productivity of 2.21 recruits per spawner. Currently, there is insufficient data available to calculate the standard trend

metrics used for other populations (Ford et al. 2010). Redd surveys have been conducted in recent years by USFS personnel; however no long-time series of survey or census data is available. The abundance/productivity status is tentatively rated at high risk, consistent with the other populations in the Middle Fork Salmon River MPG where data was available to determine risk status. The abundance/productivity risk will need to be reduced before the population can achieve its desired status.

Spatial Structure: The Lower Middle Fork population includes one minor spawning area (Horse Creek) and no major spawning areas. The number and spatial arrangements of spawning areas creates inherent risk for this population because there is no major spawning area. However, this risk is partially offset by the fact that the entire range of the population is still occupied so the extent of range and continuities between spawning areas have low risks. The cumulative spatial structure risk is rated at moderate and is adequate for the population to meet its desired status.

Diversity: The moderate rating assigned to this population is driven by the genetic variation score, which in turn is influenced by a very limited number of samples. It is very possible the actual risk for the genetic variation metric is low or very low. However, distribution across habitat types risk is rated at moderate, so the cumulative risk for the Diversity would not likely change even if the genetic variation score is actually lowered. A moderate diversity risk is adequate for the population to achieve its desired status.

Summary: The Lower Middle Fork Salmon River spring/summer Chinook population does not currently meet viability criteria because the abundance/productivity risk is likely high. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its desired status of moderate risk. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-11. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-11. Viable Salmonid Population parameter risk ratings for the Lower Middle Fork Salmon River spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M ↑ **Lower Middle Fork**	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: The watersheds occupied by the Lower Middle Fork Salmon River spring/summer Chinook population (Middle Fork Salmon River below Indian Creek) are located in wilderness areas, where most waterways are considered pristine. Due in large part to their remoteness and protected status, watersheds in the entire Middle Fork Salmon River drainage are not significantly impacted by habitat fragmentation associated with land uses, development, and habitat conversion. Approximately 99 percent of these watersheds are classified as having low impacts due to habitat fragmentation (NPPC 2004). Less than 1 percent of the total stream length in the Lower Middle Fork Salmon River watersheds has been identified as being impaired by sedimentation (NPPC 2004). There are currently no water bodies identified on the Clean Water Act 303(d) list for this population (IDEQ 2008).

Water is diverted from several tributaries in the Lower Middle Fork population for irrigation, mining, power, domestic use, and stock water (IDWR 2009). Many of these diversions are on streams without intrinsic potential for spring/summer Chinook spawning and rearing and have maximum diversion rates of less than 1 cfs, such that impacts to spring/summer Chinook habitat are likely low. However, a handful of larger water rights may impact Chinook habitat by reducing instream flow in tributaries with potential habitat or by blocking access to tributary habitat. Furthermore, it is unknown whether any of these diversions are adequately screened.

Recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage, with populations of spotted knapweed and rush skeletonweed posing the most potential to negatively impact habitat quality and quantity in the Lower Middle Fork (NPPC 2004).

Current Limiting Factors and Threats: NMFS determined the habitat limiting factors for the Lower Middle Fork Mainstem population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. Based on this analysis, we conclude that habitat-limiting factors for the population exist, but are minor.

1. Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting spring/summer Chinook productivity in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Lower Middle Fork Mainstem watershed. Potential concerns identified for this drainage include:

1.Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

2. Water diversions. It is unknown whether the water diversions in the Lower Middle Fork population bypass adequate flows, provide for fish passage, and have adequate screening in place.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition
Potential Predation Limiting Factors and Threats:
1. Invasive species. Non-native brook trout have rarely been seen in the Lower Middle Fork population (IDFG 2010), but are common in Big Creek, Bear Valley Creek, and Marsh Creek. The fish could potentially spread to the Lower Middle Fork. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions
The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder. No short-term habitat projects have been identified for the Lower Middle Fork Salmon population.

Natal Habitat Recovery Strategy and Actions
The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Consider nutrient supplementation to increase productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions
Responsibility for implementation of habitat actions this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. Idaho Fish and Game has management responsibility for Fish and Wildlife in this area. No short-term habitat projects have been identified for the Lower Middle Fork population.

Habitat Cost Estimate for Recovery
Because no specific short-term habitat improvements have been identified for this population, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

4.3.6.8 Sulphur Creek Spring/Summer Chinook Population

Abstract/Overview

The Sulphur Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted desired status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Maintained

Actions identified by this recovery plan to occur over the next 10 years should move this population to a status of maintained.

Current best available information indicates that there is a high likelihood of achieving the desired status of Maintained. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the viability target, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The Sulphur Creek spring/summer Chinook population occupies Sulphur Creek and its tributaries. It was defined as an independent population based upon its isolation from other spawning areas and its size (ICTRT 2003, p. 23). The Sulphur Creek population intrinsic potential habitat historically was distributed across one EPA level IV ecoregion (Southern Forested Mountains – 100%). There are no substantial changes in ecoregion occupancy.

The Sulphur Creek population is a Basic-sized population with a Branched Continuous A type spawning complexity. This population contains spring run fish, and consists of one major spawning area. The basic population information is shown in Figure 4.3-18.

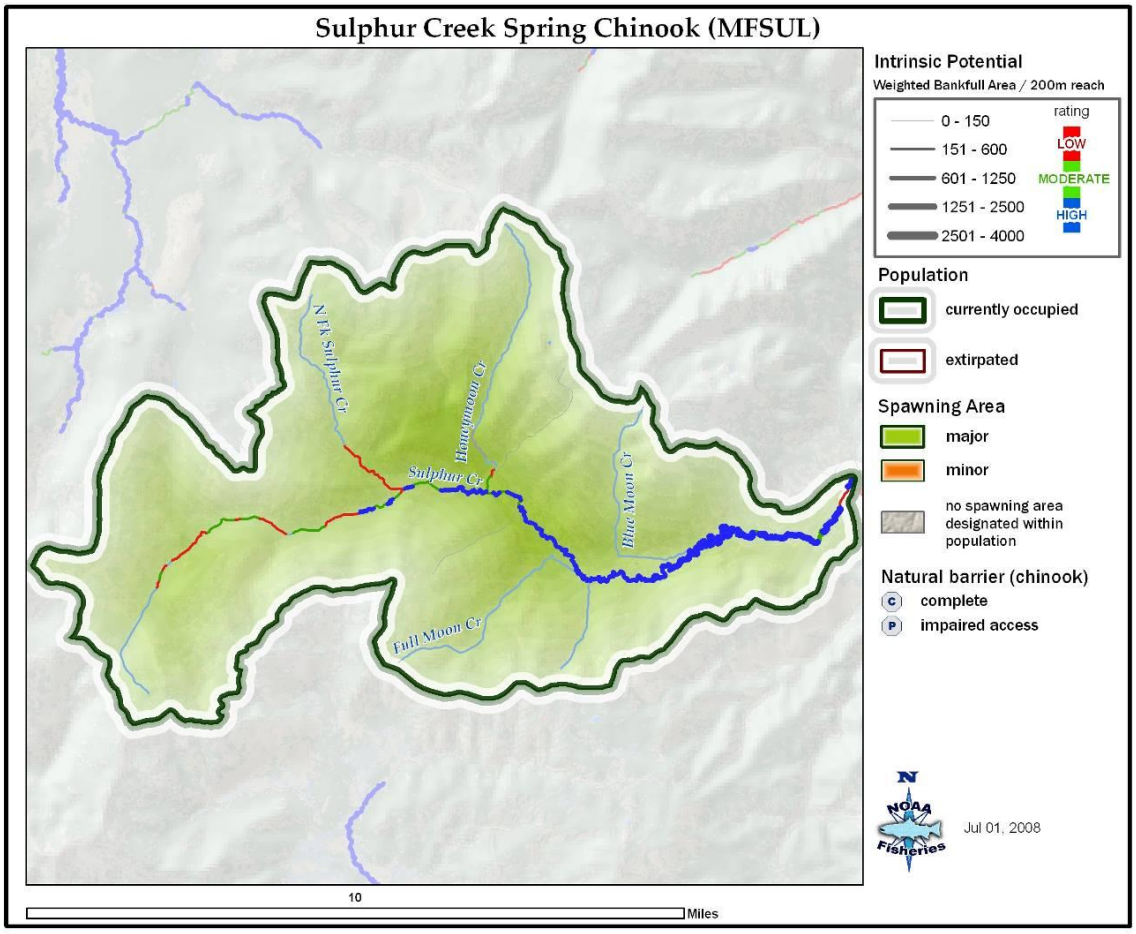

Figure 4.3-18. Sulphur Creek spring Chinook population.

Abundance and Productivity: The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance and productivity that correspond to a particular risk level. As seen in Figure 4.3-19, a desired risk level can be achieved with various combinations of abundance and productivity. For the Sulphur Creek population, the desired status of maintained can be attained with any combination of abundance and productivity that is above the red dashed line. As a basic population, Sulphur Creek can achieve viable (low risk) status (the green line) with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21.

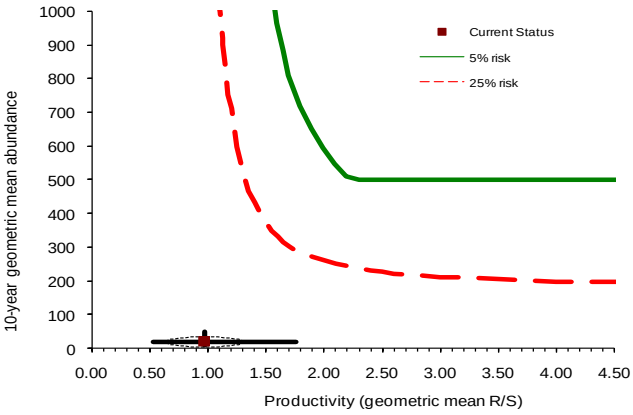

Figure 4.3-19. Sulphur Creek Abundance and Productivity Curve.

Currently, the 10-year (2000-2009) geometric mean adult spawner abundance is 37 fish, and the 10-year return per spawner productivity for the same period is 0.76, both substantially lower than the minimum thresholds for either maintained or viable status (Ford et al. 2010). The abundance/productivity risk for the population is therefore rated as high.

Spatial Structure: The Sulphur Creek population consists of just one major spawning area, and this limited spatial structure creates some inherent risk for the population's viability. However, the cumulative risk for spatial structure is tempered by the very low risk in the population that is due to the fact that the entire historic range is still occupied. The cumulative risk for spatial structure is rated as low.

Diversity: The moderate rating assigned to this population is driven by the genetic variation score which is influenced by an absence of data assessing genetic variation. It is very possible that the actual risk for the genetic variation metric is low or very low. The cumulative risk assigned to spatial structure and diversity has been rated moderate risk. This is adequate to meet the desired status for the population.

Summary: The Sulphur Creek spring/summer Chinook population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Sulphur Creek population cannot reach its desired status. The spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-12. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-12. Viable Salmonid Population parameter risk ratings for the Sulphur Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M ↑ **Sulphur Creek**	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: The watershed occupied by this population suffered some degradation from its historical conditions (NMFS 2004). Historic livestock grazing has reportedly resulted in localized accelerated erosion, upland compaction, and streambank degradation, but conditions are reported to be on an improving trend. The area is now primarily closed to sheep and cattle grazing (USDA 2003b). No waterbodies are currently identified on the Clean Water Act 303(d) list for this population (IDEQ 2008); however, a past habitat quality survey indicates dewatering of 3.7 miles of Blue Moon Creek (IDFG 1989).

Most of the Sulphur Creek watershed lies within the Frank Church Wilderness of No Return, and current land use in the Sulphur Creek area focuses primarily around wilderness-oriented, dispersed recreation. However, water diversions for irrigation, storage, and power are located on private land within the wilderness (NMFS 2004). Few noxious weeds and exotic plants have been located within the drainage, although spotted knapweed is considered the primary weed of concern (USDA 2003a). Finally, habitat in Sulphur Creek includes extensive pond complexes associated with beaver and indicative of pristine habitat.

Current Limiting Factors and Threats: NMFS determined the habitat limiting factors for the Sulphur Creek population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. Based on this analysis, we conclude that habitat limiting factors for the population exist, but are minor.

1. Low streamflows due to water diversions.
Water rights exist for close to 5 cfs to be diverted from Blue Moon Creek for irrigation, domestic use, power, and a storage pond on private land within the wilderness (IDWR 2009). While the ICTRT does not list Blue Moon as having intrinsic potential for spring/summer Chinook, current distribution maps indicate that Blue Moon Creek is used by spring/summer Chinook for both spawning and rearing (StreamNet 2009). It is unknown whether the diversions on Blue Moon Creek currently leave adequate instream flow for spawning and rearing, allow for fish passage, or have screens in place to prevent fish entrainment in diversion ditches.

2. Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting spring/summer Chinook productivity in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Sulphur Creek watershed. Potential concerns identified for this drainage include:

1. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on USFS grazing allotments remain current should minimize any effects from grazing.

2. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition
Potential Predation Limiting Factors and Threats:
1. Invasive species. Non-native brook trout have rarely been seen in Sulphur Creek (IDFG 2010), but are common in the Bear Valley Creek and Marsh Creek areas, immediately upstream. The fish could potentially spread to the Sulphur Creek area. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can impact Chinook abundance and productivity.

Recovery Strategies and Actions
The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions
The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Evaluate existing water diversions to assure that diversions bypass adequate flows, provide for fish passage, and have adequate screening in place.
2. Consider nutrient supplementation to increase productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NMFS's Northwest Fisheries Science Center are exploring the potential benefits of this action.

Implementation of Habitat Actions
Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. Idaho Fish and Game has management responsibility for fish and wildlife in this area. No short-term habitat projects have been identified for the Sulphur Creek spring/summer Chinook population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvements have been identified and funded, the cost estimate for habitat improvements is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]

4.3.6.9 Camas Creek Spring/Summer Chinook Population

Abstract/Overview

The Camas Creek spring/summer Chinook population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted desired status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Desired Status
High Risk	Maintained

Actions identified by this recovery plan to occur over the next 10 years should move this population to a status of maintained.

Current best available information indicates that there is a high likelihood of achieving the desired status of Maintained. However, there is a high degree of uncertainty in estimating the nature and timing of a population's response to various recovery strategies, determining the gap between the current status and the viability target, and determining the amount of improvement necessary to achieve the viability target for this population. Due to this uncertainty, it is important to use an adaptive management strategy, in conjunction with the ESA's five-year status reviews and the information in the research, monitoring and evaluation chapter. If the initial actions do not produce the intended response, it is imperative to identify those actions that are most likely to yield additional improvement.

Introduction

This section of the recovery plan compares the population's desired status to its current status, and describes how the population fits into the recovery strategy for the MPG and ESU. The primary sources of information are the ICTRT viability criteria (NMFS 2007b) and the ICTRT memo *Scenarios for MPG and ESU Viability Consistent with ICTRT Viability Criteria* (ICTRT 2007c).

Population Status

This description of the population's current status presents information from the ICTRT's most current status assessment (ICTRT 2010) and other available data. It focuses primarily on population Abundance and Productivity, and compares the population's current status to the desired status in terms of both abundance and productivity. It also summarizes Spatial Structure and Diversity concerns identified by the ICTRT. Diversity concerns are also discussed in the hatchery section. More details are available in the status assessment (ICTRT 2010).

Population Description: The ICTRT (2003) distinguished Camas Creek spring/summer Chinook as an independent population based on genetic and geographic isolation. The population was classified as a "basic" sized population based on historical habitat potential. A basic-sized population's minimum threshold abundance is 500 adult returning spawners. There is one major spawning area and one minor spawning area within this population and all historically occupied areas are still occupied.

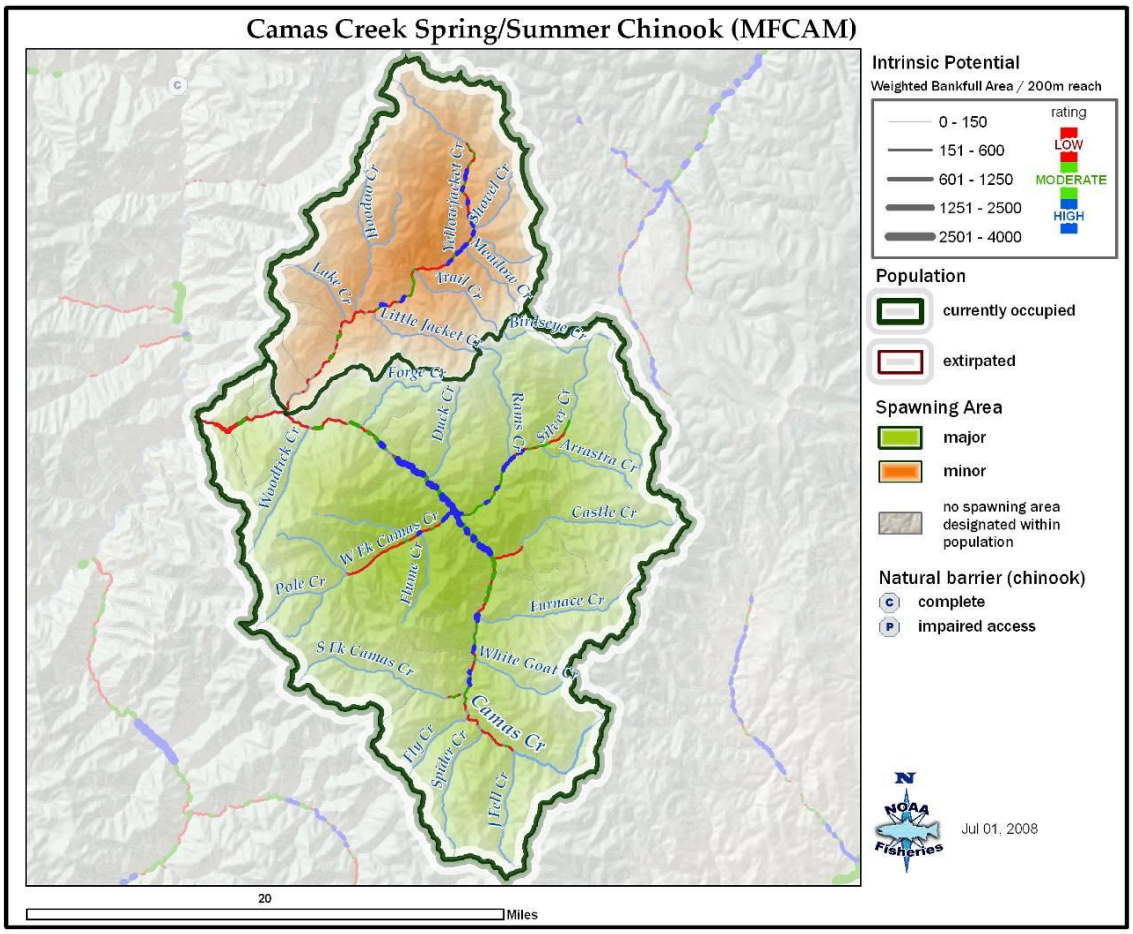

Figure 4.3-20. Camas Creek Spring/Summer Chinook Population.

Abundance and Productivity: The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural origin abundance and productivity that correspond to a particular risk level. As seen in Figure 4.3-21, a desired risk level can be achieved with various combinations of abundance and productivity. For the Camas Creek population, the desired status of maintained can be attained with any combination of abundance and productivity that is above the red dashed line in Figure 4.3-20. As a basic population, Camas Creek can achieve viable (low risk) status (the green line) with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21. In contrast, the recent 10-year (2000-2009) geometric mean adult spawner abundance for the Camas Creek spring/summer Chinook population is 30 fish. Based on recent adult spawner recruit series, the 10-year recruit per spawner productivity

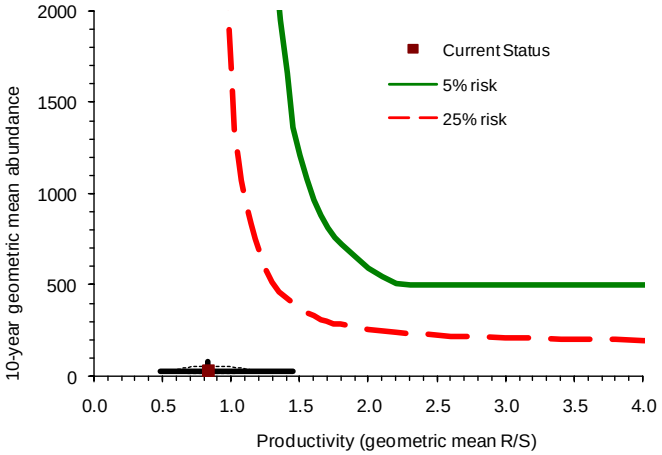

Figure 4.3-21. Camas Creek abundance and productivity curve.

estimate for the same period is 0.74, which is less than the 2.21 productivity required at the minimum abundance threshold (Ford et al. 2010). Current abundance and productivity are also well below the minimums needed for a maintained status. The abundance/productivity risk for the population is therefore high.

Spatial Structure: The Camas Creek population contains spring run fish. It includes one major spawning area (Camas Creek) and one minor spawning area (Yellowjacket Creek). Current spawning distribution mirrors historical range. The major spawning area is occupied at both the lower and upper ends based on recent spawner surveys. Therefore, this population is rated as low risk for spatial structure. This is adequate to achieve the desired status.

Diversity: The moderate risk rating assigned to diversity risk for this population is driven by the genetic variation score, which in turn is influenced by a very limited number of samples. It is very possible the actual risk for the genetic variation metric is low or very low. All other diversity risks for this population are rated as low or very low. The moderate risk rating for diversity does not preclude the population from attaining its desired status.

Summary: The Camas Creek spring/summer Chinook population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Camas Creek population cannot reach its desired status. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 4.3-13. A complete version of the Interior Columbia River Technical Recovery Teams draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 4.3-13. Viable Salmonid Population parameter risk ratings for the Camas Creek spring/summer Chinook population. The population does not meet population-level viability criteria.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M ↑ **Camas Creek**	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to desired risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary and plume, and by climate change. Section 4.1.1 discusses these regional-level factors.

Natal Habitat

Habitat Conditions: Camas Creek drains approximately 400 square miles and flows into the Middle Fork Salmon River at RM 35. The lower eight miles of Camas Creek and the headwaters of Camas Creek are within the Frank Church – River Of No Return Wilderness. There are approximately 260 miles of perennial streams in the Camas Creek drainage, approximately 250 miles of which are on land administered by the USFS, with the remaining 10 miles of stream on private lands.

Fifty six percent of the Camas Creek watershed is in the Frank Church River of no Return Wilderness (NMFS 2005) and overall road density in the drainage is only 0.25 miles per square mile. Most (possibly all) road crossings are stream fords or bridges and no impassible road crossings have been identified in anadromous fish habitat (SCNF 1994).

Mining activity has probably occurred throughout the Camas Creek watershed, but noticeable impacts of past mining are mostly confined to the Yellowjacket, Silver, and Lower Camas subwatersheds. There are 676 acres of patented mining lands in the watershed and test drilling and surface sampling with shovels still occurs on some of the private lands (SCNF 1994). Recent commercial-scale mining activity is confined to one open pit gold mine that operates on 24 acres of private and USFS land in the Yellowjacket Creek subwatershed (SCNF 2004). Placer mining is prohibited in the Middle Fork Salmon River drainage (Public Law 96-312), but future open pit or subsurface mining on private land is a potential threat to anadromous fish and habitat in the Camas Creek watershed.

Current Limiting Factors and Threats: NMFS determined the habitat limiting factors for the Camas Creek population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. Based on this analysis, we conclude that habitat limiting factors for the population exist, but are relatively minor.

1. Low streamflows due to water diversions.
Water diversions reduce streamflow in the Yellowjacket Creek, Duck Creek, Silver Creek, and Castle Creek drainages. The maximum diversion rate of all water rights in the Yellowjacket Creek drainage is less than 10 percent of base flow, and 70 percent of those water rights are associated with mines that are not currently in production, so water use probably has a minimal impact on spring/summer Chinook production in the Yellowjacket Creek drainage. However, the one operating water diversion in Yellowjacket Creek is unscreened, so fish may be entrained and killed in the diversion.

The impact of water diversions on flow in the Silver Creek, Duck Creek, and Castle Creek drainages may be enough to reduce Chinook production in those drainages. Most of these diversions are on USFS lands and are undergoing ESA section 7 consultation, which should minimize impacts on Chinook. The Silver, Duck, and Castle Creek drainages contain only 4.2 percent of rearing habitat (measured as smolt capacity) for the Camas Creek spring/summer Chinook population, so even relatively severe impacts on habitat in these drainages would probably have a small effect on the population.

Water use in tributaries of Camas Creek probably reduces flow in mainstem Camas Creek by less than 5 percent of base flow and likely has a minimal impact on spring/summer Chinook production. There is one small private hydropower diversion within the spawning and rearing areas that reduces flow in a 1.1-mile reach of Castle Creek.

2. Degraded habitat conditions and reduced fish passage.
Some localized habitat perturbations in the Camas Creek drainage include: a dam that blocks migration into Rams Creek (Silver Creek drainage), a dam and pond that could raise water temperatures and impair migration in Silver Creek, heavy grazing of riparian habitat on private land in the Silver Creek drainage, channel modifications on private land in the Duck Creek drainage (tributary of mainstem Camas Creek), and cattle walking through Chinook redds in mainstem Camas Creek. Although locally severe, these habitat perturbations impact a small percentage (less than 5%) of spring/summer Chinook spawning and rearing habitat in the Camas Creek drainage.

3. Reduced habitat function and processes due to loss of beaver activity.
The extent of beaver pond complexes in the Camas Creek drainage is not known. Beaver dams increase pool habitat, catch fine sediments, and raise water tables, providing high quality habitat for rearing juvenile spring/summer Chinook. In Camas Creek, beaver populations and extensive pool complexes may be less than optimal in terms of habitat function. In the mid-1990s, private landowners apparently removed a substantial number of beavers from the Silver Creek drainage, resulting in adverse impacts on salmonid habitat (Bruce Smith, personal communication). There is currently a considerable amount of beaver activity in lower Silver Creek (Bob Rose, personal communication), so the beaver population, and stream habitat, might be recovering. The Camas Creek drainage is open to beaver trapping during the trapping season and beaver perceived to be a nuisance can be removed during any time of the year, so salmonid habitat in the Camas Creek drainage is likely to continue to be adversely impacted by beaver removal.

4. Nutrient deficiency.
No completed studies have tested whether a lack of marine-derived nutrients is limiting spring/summer Chinook productivity in any of the Middle Fork Salmon River populations. However, Middle Fork Salmon River watersheds are naturally nutrient-poor and current numbers of returning adults are far below estimated historic numbers, such that nutrient deficiency may be a limiting factor.

Potential Habitat Limiting Factors and Threats: Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Camas Creek watershed. Potential concerns identified for this drainage include:

1. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on USFS grazing allotments remain current should minimize any effects from grazing.

2. Excess sediment and reduced water quality and quantity from new mineral exploration and mining activity.

Hatchery Programs
[Section to be developed]

Harvest Management
[Section to be developed]

Predation/Competition

Potential Predation Limiting Factors and Threats:

1. Invasive species. Non-native brook trout have rarely been seen in the Upper Middle Fork population (IDFG 2010), but are common in other parts of the Middle Fork Salmon River basin and could eventually spread to Camas Creek. Section 4.3.6.1 for the Big Creek spring/summer Chinook population describes research findings on how brook trout can affect Chinook abundance/productivity.

Recovery Strategies and Actions

The recovery strategies that address a limiting factor may include both short-term and long-term actions. Short-term actions are projects scheduled to be implemented within the next 10 years by a resource management agency or local stakeholder group. Long-term actions are categories of actions that could increase productivity for the population, but for which a specific project has not yet been proposed by a resource management agency or other stakeholder.

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters while moving the population towards a viable status.

1. Continue to improve grazing management to minimize the impacts of redd trampling and riparian vegetation impacts.
2. Continue to improve irrigation and water withdrawal practices to minimize the impacts of water diversions.
3. Consider nutrient supplementation to improve productivity. It may be appropriate to investigate if nutrient supplementation can be used as a short-term method to boost productivity in the natal habitat. Ongoing studies by NMFS's Northwest Fisheries Science Center are exploring the potential benefits of this action.
4. Encourage additional beaver activity in the Camas Creek watershed.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the USFS. Following the existing USFS Land and Resource Management Plan should provide the protection needed for this population. IDFG has management responsibility for fish and wildlife in this area. No short-term habitat projects have been identified for the Camas Creek population.

Habitat Cost Estimate for Recovery

Because no specific short-term habitat improvements have been identified and funded, the cost estimate for habitat is zero.

Hatchery Recovery Strategy and Actions

[to be added]

Harvest Recovery Strategy and Actions

[to be added]